THE FOUNDRY

Vol. 43 No. 7 Whole No. 275 Cleveland, Ohio, July 1915

How Boiler and Greenhouse Parts Are Molded

Interesting Details Covering the Practice of Lord & Burnham Co. in Manufacturing Heating Boilers and Special Cast Parts for Greenhouses

By E C Kreutzberg

IN THE November, 1914, issue of *The Foundry* an article was published directing attention to the high degree of efficiency and the great increases in production made possible by the joint use of jar-ramming and stripping-plate molding methods, as exemplified by the practice at the cast iron boiler shop of the H. B. Smith Co., Westfield, Mass. In marked contrast to the equipment at the H. B. Smith foundry is that at another modern boiler shop, operated by the Lord & Burnham Co., Irvington, N. Y. This company has been able to achieve remarkable results by using plain patterns, in conjunction with molding machines of the pneumatic, combination jar-ramming, roll-over and pattern-drawing type manufactured by the Herman Pneumatic Machine Co., Zelienople, Pa. The results made possible by this equipment are indicated by the fact that one of these combination machines, when served by a crew of one molder and three helpers, produces as many molds per day as seven molders and seven helpers could put up by the old method of ramming by hand and turning the molds and drawing the pattern with the aid of a crane.

Two Herman machines are used at this plant, one having a 36 x 44-inch and the other a 50 x 60-inch table. These machines are engaged entirely in the production of cast iron boiler section molds, which are put

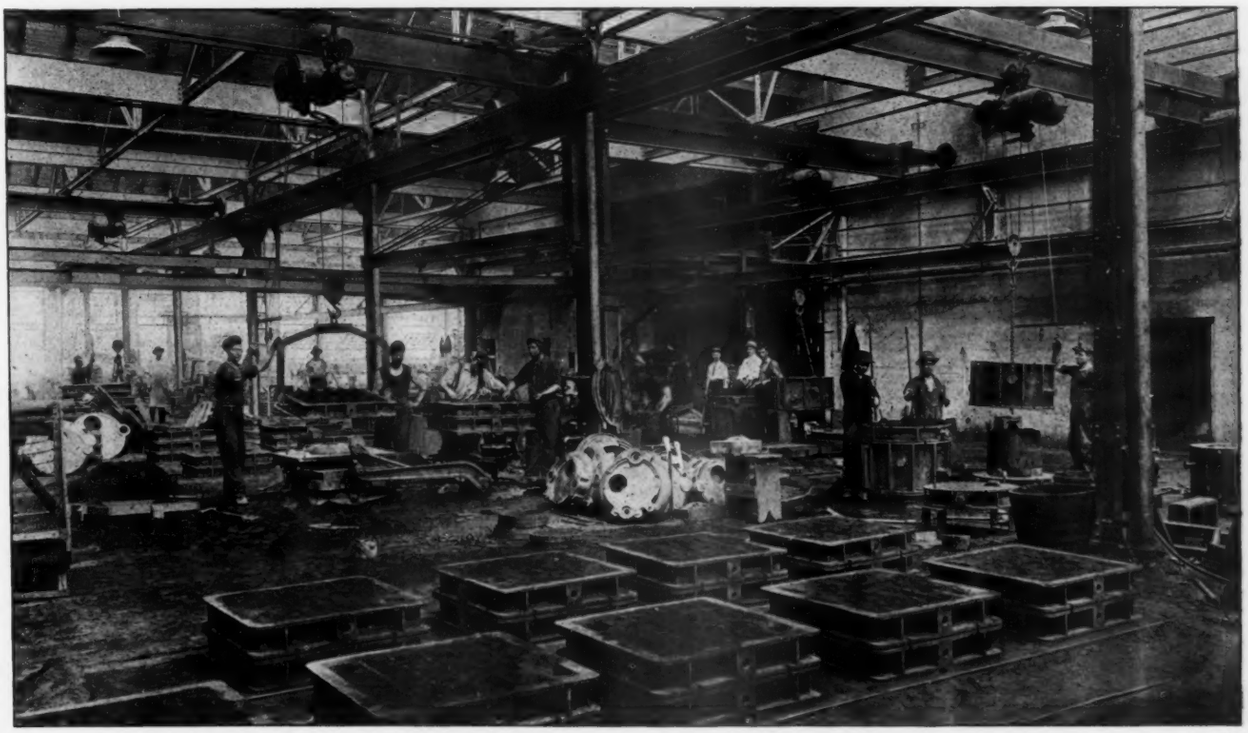


FIG. 1—GENERAL VIEW OF FOUNDRY SHOWING OVERHEAD MONORAIL AND CRANE SYSTEMS

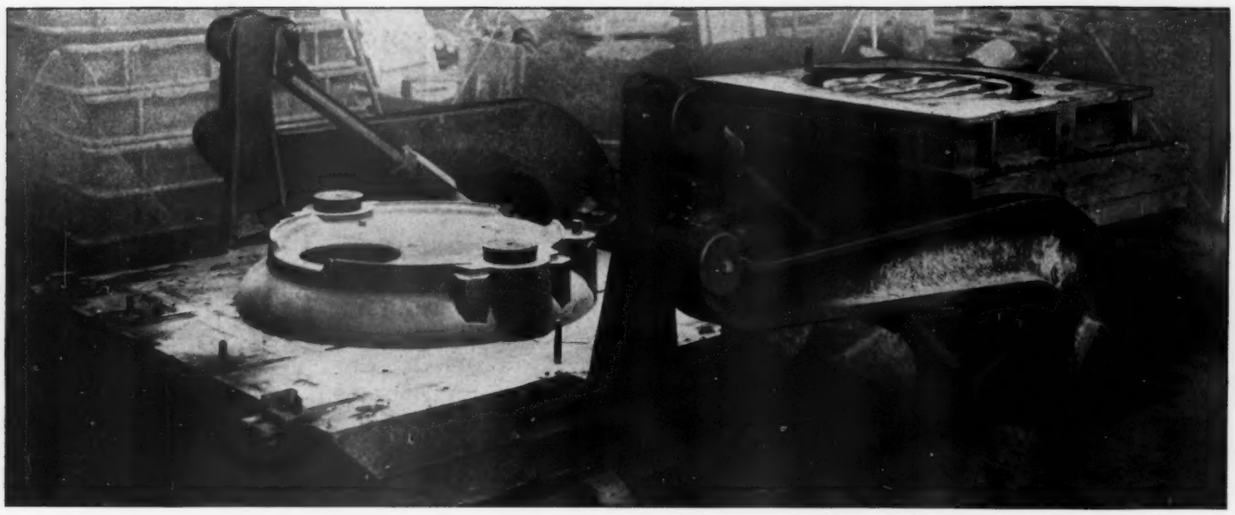


FIG. 2—HERMAN JAR-RAM ROLL-OVER AND PATTERN-DRAWING MACHINE, SHOWING 28-INCH STEAM DOME SECTION PATTERN MOUNTED ON PATTERN PLATE. FINISHED DRAG FOR 28-INCH CORRUGATED SECTION, MADE JUST BEFORE CHANGING THE PATTERN, IS SHOWN ON DRAWING DEVICE

up in cast iron flasks. The operations of ramming, turning the molds and drawing the pattern are performed entirely by the machines, a crane being required only for shifting flasks and molds to and from the machines. In each machine the pattern is screwed to the swinging face plate and after the desired number of molds have been produced the pattern is unscrewed and replaced by another. In this manner, each machine may be used to put up molds for several different kinds and sizes of sections, to be cast in the same heat. Of special significance is the arrangement of the jolting platform and the drawing mechanism, which are independent of each other and may be kept in practically continuous service; the period required for shoveling sand and jolting a mold on the jar-platform is utilized to advantage in finishing the previous mold and transferring it to the floor.

The regular sequence in which these machines operate is illustrated clearly in Figs. 2, 3, 4, 5 and 6. Fig. 2 shows the 50 x 60-inch machine immediately after a 28-inch corrugated section pattern has been replaced by a pattern for a 28-inch steam dome section; the illustration shows the pattern mounted on the face plate, while on the frame of the pattern-drawing mechanism is a finished, corrugated section drag. Fig. 3 shows the flask in place over the pattern and also the method of adjusting the crane for removing the corrugated section drag from the platform of the drawing device. In Fig. 4 the corrugated section mold has been removed and the steam dome section mold is ready to be jolted, while at the left is shown a flask from the previous heat brought from the floor and about to be shaken-out. Fig. 5 shows the method of swinging the finished steam dome drag over to the drawing device. Fig. 6 shows the pattern drawn and being returned to the jolting platform, while in the background at the right is a flask, just shaken out, hooked to a crane

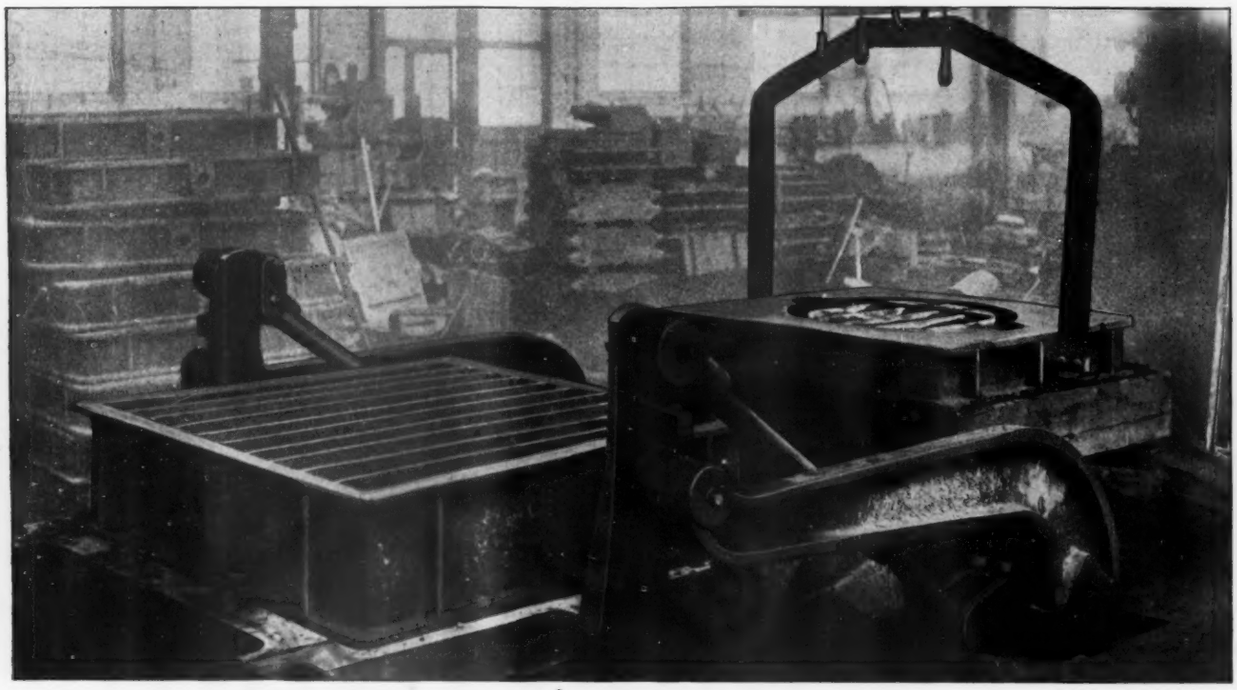


FIG. 3—FLASK PLACED FOR MAKING STEAM DOME DRAG, ALSO SHOWING CORRUGATED SECTION MOLD ABOUT TO BE TRANSFERRED TO FLOOR

FIG. 4—STEAM DOME DRAG READY TO BE JAR-RAMMED—SUSPENDED FROM CRANE IS A MOLD FROM PREVIOUS HEAT READY TO BE SHAKEN OUT

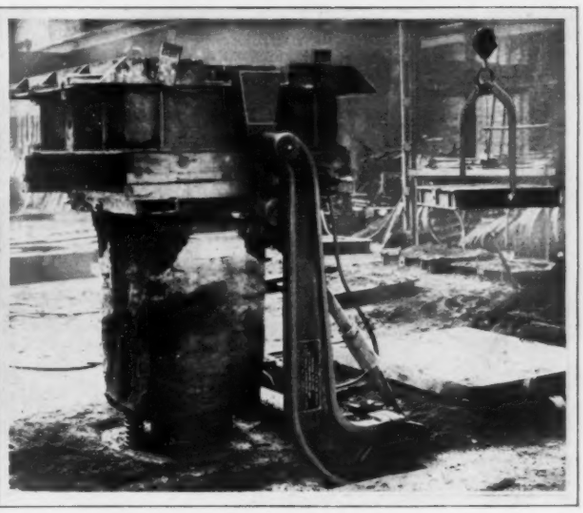


FIG. 5—THE MOLD AND PATTERN PLATE, AFTER RAMMING, ARE SWUNG OVER ON PATTERN DRAWING DEVICE

and ready to be placed over the pattern. The floor allotted to this machine is 35 x 60 feet and the normal output is 23 molds daily, including six of the large steam dome type; formerly in a day a molder and helper put up two steam-dome section molds, or four corrugated section molds daily. The 50 x 60-inch machine is mounted on a concrete slab, 17 feet square and 2 feet deep. This machine produces molds for round boiler sections from 25 inches up to and including 31 inches and steam dome sections for 22 to 31-inch boilers, inclusive. The 36 x 44-inch machine is used for making molds for sections of smaller diameters. A 35 x 80-foot floor is allotted to this machine; its regular daily production is 48 molds, while as many as 56 molds have been produced. The former output, by hand-molding methods, was six or eight molds daily for a molder and helper.

Details of the Flasks

The cast iron flasks employed in connection with these machines are square, as shown in Fig. 7. Instead of having permanent bars, these flasks permit of the use of interchangeable flask bars which may be fitted into vertical, tapered grooves where they are secured by cast iron pins or wedges. Thus a flask may be used for any kind of work which will come within its dimensions; all that is necessary is to fit it with suitable bars and it is not necessary to keep nearly as many flasks on hand as would be required if the bars were cast-in permanently. As a consequence, considerable expense has been saved. Fig. 7 shows a typical flask of this char-

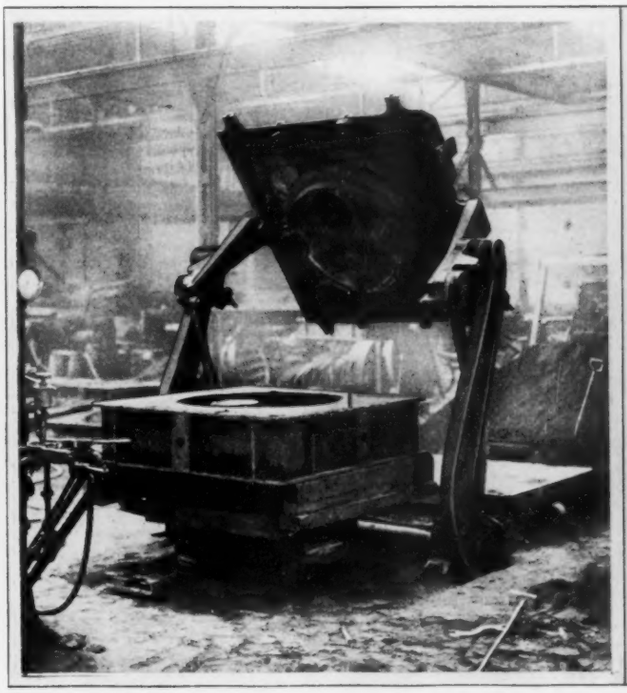


FIG. 6—MOLD LOWERED AWAY FROM PATTERN, WHILE PATTERN PLATE AND PATTERN ARE BEING SWUNG BACK TO ORIGINAL POSITION FOR MAKING ANOTHER MOLD

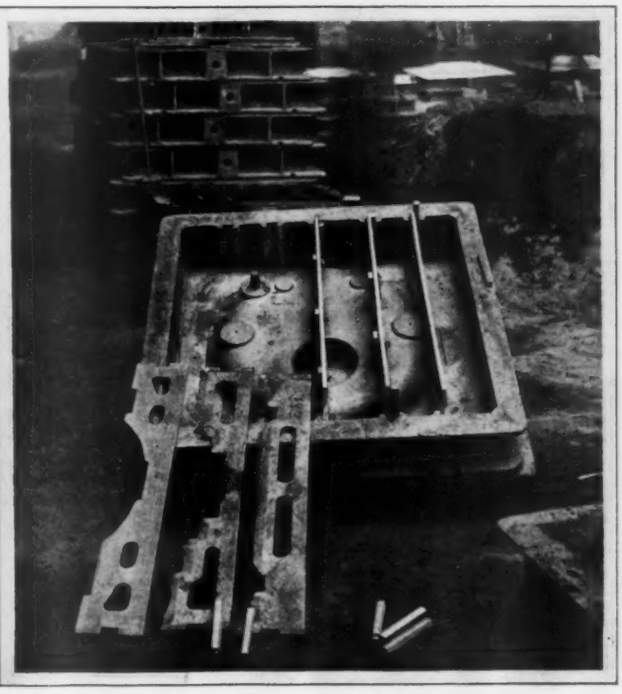


FIG. 7—TYPICAL CAST IRON FLASK EMPLOYED IN CONNECTION WITH ROLL-OVER MOLDING MACHINES. THIS VIEW SHOWS A FEW INTERCHANGEABLE FLASK BARS AND INDICATES THE METHOD OF FITTING THEM TO FLASKS

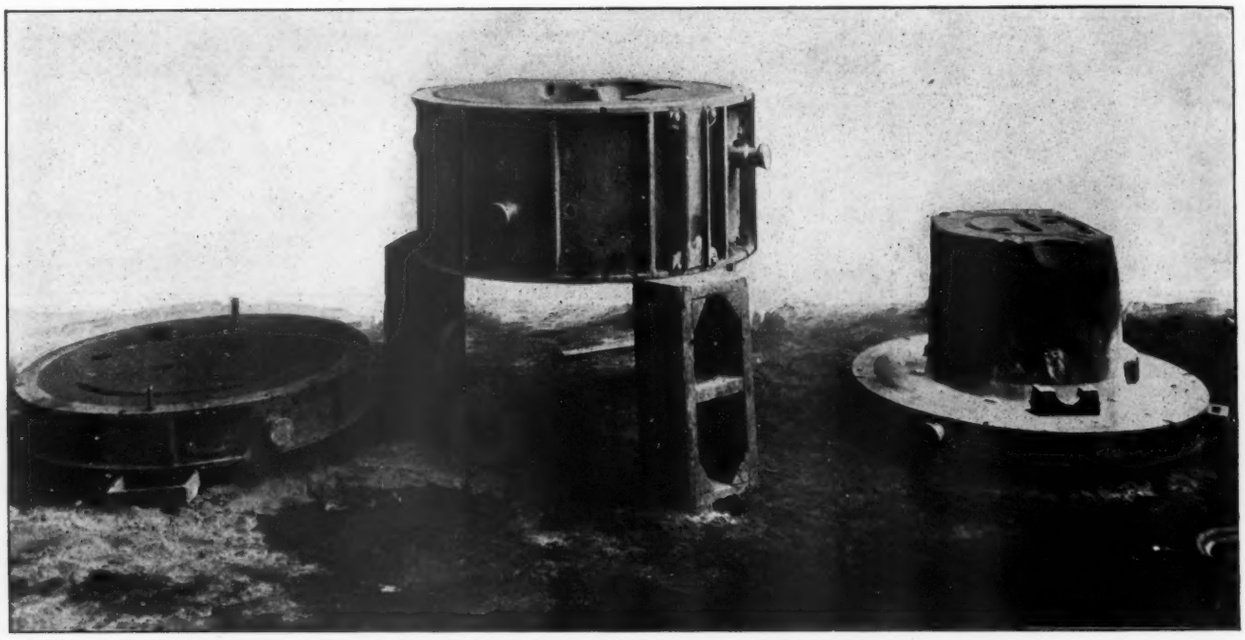


FIG. 8—FROM LEFT TO RIGHT THIS ILLUSTRATION SHOWS THE COPE, CHEEK AND GREEN SAND CORE AND DRAG FOR 28-INCH FIRE POT MOLD

FIG. 9—PATTERN FOR 28-INCH FIRE POT SECTION

acter, together with interchangeable bars for different kinds of work. In these flasks the use of trunnions is avoided; they are replaced by cast iron blocks which are located on the sides, their surfaces being flush with the edges of the top and bottom flanges. These blocks contain sockets which are engaged by pins on the lifting device of the crane. This lifting device is of the shear type and the flasks are lifted much in the same manner as a cake of ice is carried by tongs.

The company shortly plans to produce fire pot sections for circular boilers with the aid of the combination, jar-ramming, roll-over and pattern-drawing machines, and the equip-

FIG. 11—DRY SAND CORE PLACED OVER GREEN SAND CORE PREPARATORY TO CLOSING MOLD

FIG. 10—AT THE LEFT IS A 28-INCH FIRE POT SECTION, AND AT RIGHT IS A 28-INCH STEAM DOME

ment for firepot sections recently has been re-designed with this purpose in view. The present method of producing such castings is shown in Figs. 8, 9 and 11. Fig. 9 shows the pattern for a 28 - inch firepot mounted on an ordinary bottom board. Fig. 8 shows a drag and green sand core, also a cheek and covering cope made from this pattern. Fig. 11 illustrates the drag and green sand core of the mold provided with the dry sand core, ready for the cheek and cope to be put in place. In making this mold, the cheek and green sand core are rammed first and turned over, after which the drag is rammed. The partially completed mold then is rolled back and the cope is rammed. The cope and cheek then are lifted off and the pattern drawn, after which the dry sand core is set in place and the mold closed. These molds are rammed on a pneumatic jolter, to which they are transported by overhead, floor-operated traveling cranes.

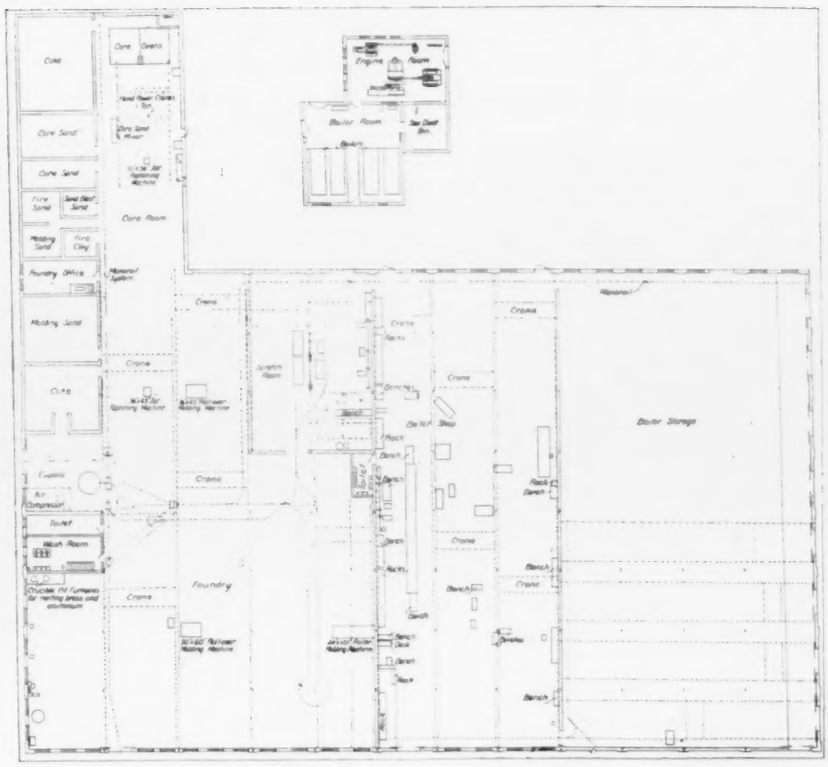


FIG. 12—GENERAL LAYOUT OF NEW FOUNDRY, CLEANING ROOM, BOILER SHOP AND BOILER STORAGE BUILDINGS OF LORD & BURNHAM CO.

The Lord & Burnham Co.'s entry into the manufacture of cast iron boilers was originally the result of an effort to provide a suitable boiler for heating greenhouses, of which the company is a prominent designer and manufacturer. The boiler was placed on the market in 1873 and so far as is known, this was the first cast iron, sectional boiler made. It was assembled sidewise, the sections having been connected by cast sockets into which branch fittings were calked. It consisted of a right and a left hand section and as many center sections as were required. The boiler rendered satisfactory service, but due to the rapidity with which rust formed between the sections, repairs often were necessary and were made with great difficulty. Consequently, the company adopted a new type of boiler in 1878; this was fitted with brass tubes, which burned out rapidly with the result that in the early eighties the company changed its design and built a new style of boiler which it continued to manufacture for 20 years. This boiler was cast in one piece. It did not meet with favor because it was hard to handle. It finally was succeeded by the company's present style, which is a

FIG. 13—ROLLER-RAMMING MACHINE FITTED WITH COPE PATTERN FOR MAKING GREENHOUSE GUTTER MOLDS

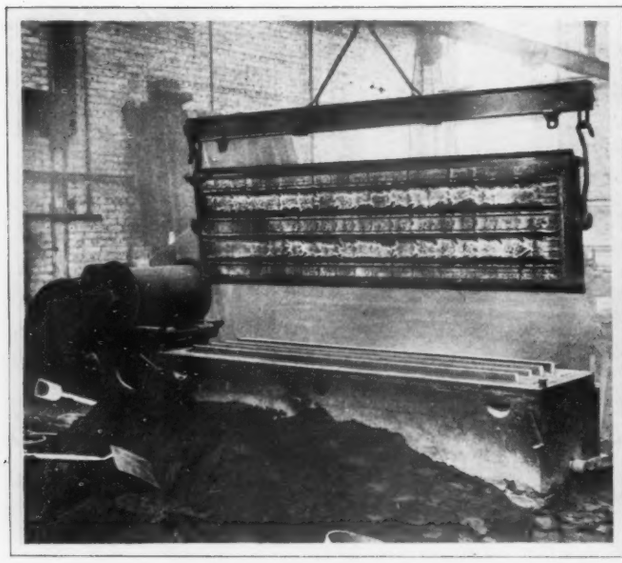


FIG. 14—ROLLER MACHINE WITH DRAG PATTERN FOR GUTTER MOLD, SHOWING FINISHED DRAG SUSPENDED FROM CRANE

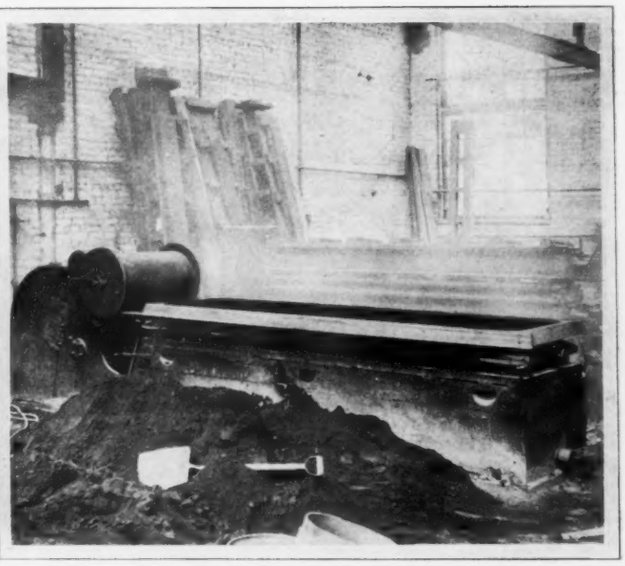


FIG. 15—METHOD OF USING WOOD FRAME TO INSURE UNIFORM DISTRIBUTION OF SAND

sectional adaptation of its predecessors. In the production of greenhouse castings also, the Lord & Burnham Co. has mounted practically all its patterns on match-plates and the molds are rammed on molding machines, with the result that the output has been increased by from 200 to 300 per cent. The machines employed for producing molds for small greenhouse castings, include two Osborn jolt-squeezers, two Mumford hand squeezers, three Pridmore rock-overs, one International jolt and one Farwell hand squeezer.

For molding cast iron gutters and sills for greenhouses, a roller ramming machine, manufactured by Richey, Brown & Donald, Maspeth, L. I., N. Y., has been installed. The pattern, as shown in Fig. 13, is mounted on a face plate, which rests on links; the latter are supported by toggles, which, in turn, are supported by two horizontal shafts, the latter resting on bearings in the legs of the machine. By moving a lever which actuates the shafts through gears, the face plate may be moved up and down. The face plate also rests on two plungers, which operate in compressed air cylinders; the function of these cylinders is to balance the weight of the face plate, which is approximately 2,000 pounds. Each end of the face plate is provided with a 3 x 3-inch guide bar. The function of these guide bars is to keep the plate in perfect alignment, or, in other words, to insure steadiness and accuracy in drawing the pattern from the mold. These guide bars operate vertically in bearings in the legs. The machine also is equipped with adjustable side plates, whose surfaces are flush with the surface of the pattern plate. These side plates can be moved horizontally to conform to the width of the pattern. The base of the machine is fully enclosed to keep sand and dust out of the bearings and wearing parts.

As shown in Fig. 16, the machine is equipped with a bar of the broken-link type for rolling the rammer across the mold. In this form of construction the bar, instead of wasting considerable space at the rear of the

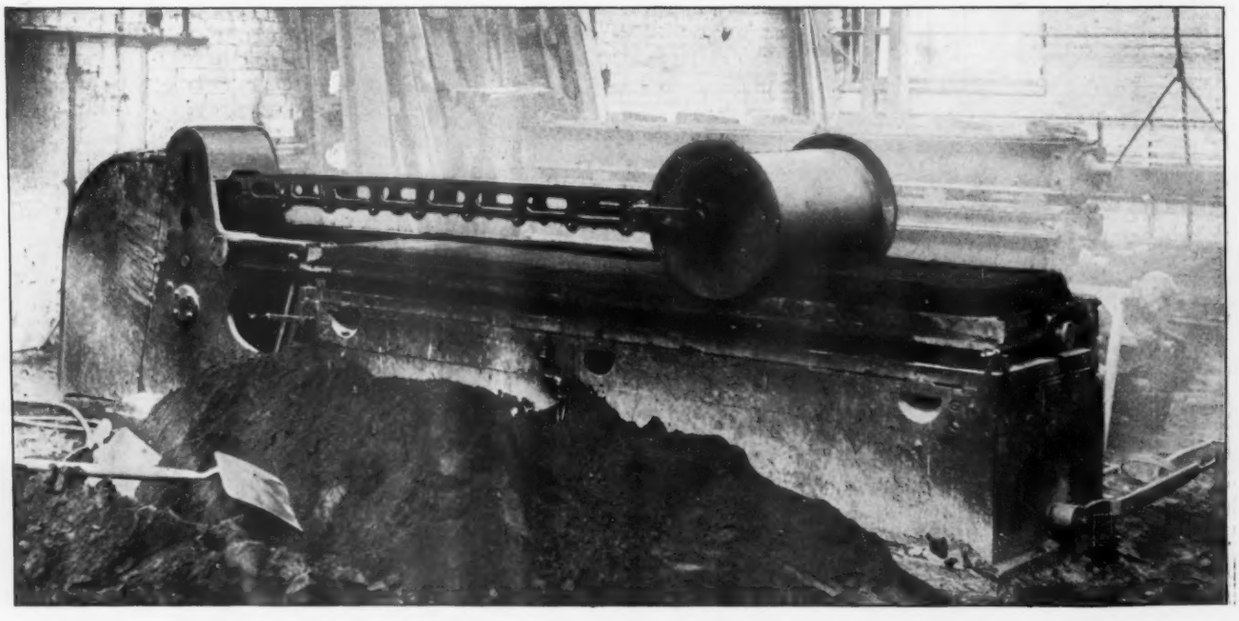


FIG. 16—RAMMING THE MOLD, SHOWING BROKEN LINK CONSTRUCTION OF ROLLER BAR

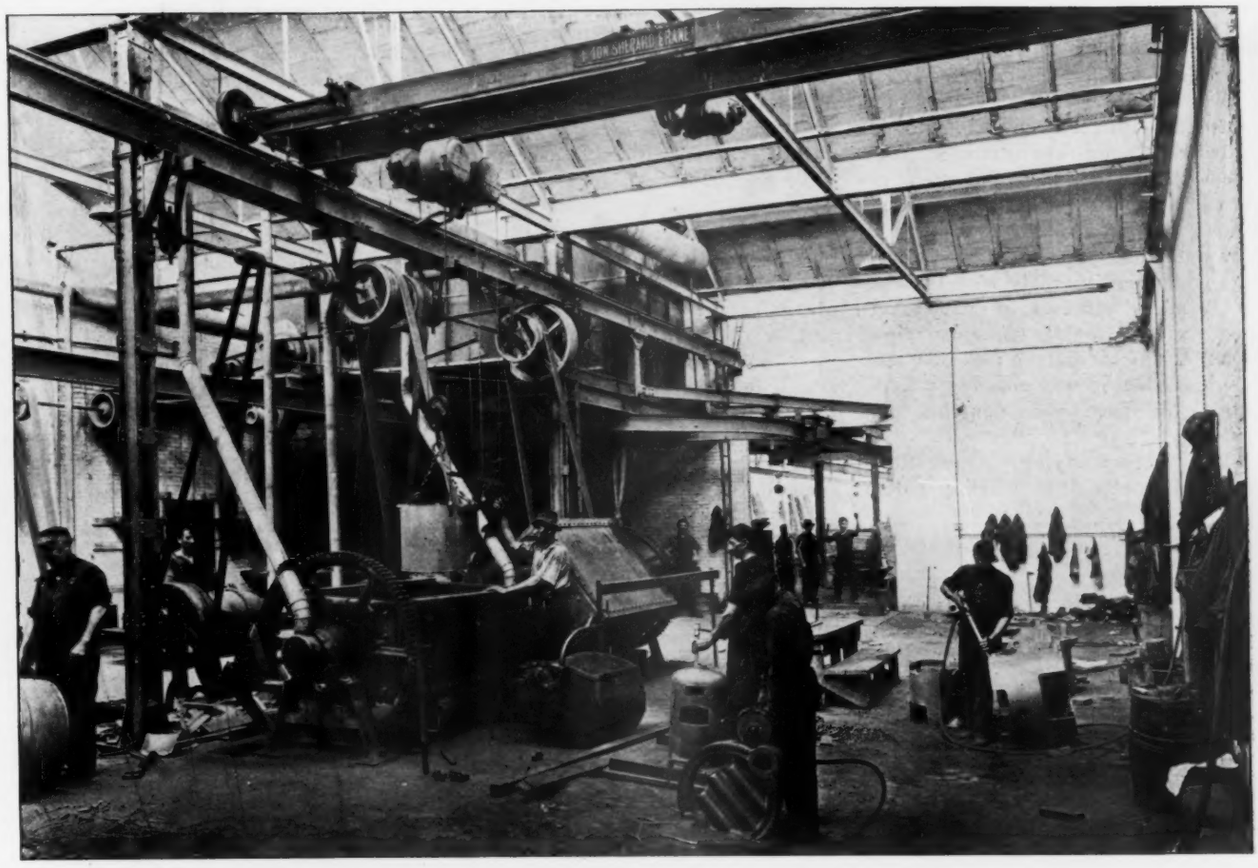


FIG. 17—GENERAL VIEW OF CLEANING AND SANDBLAST DEPARTMENT

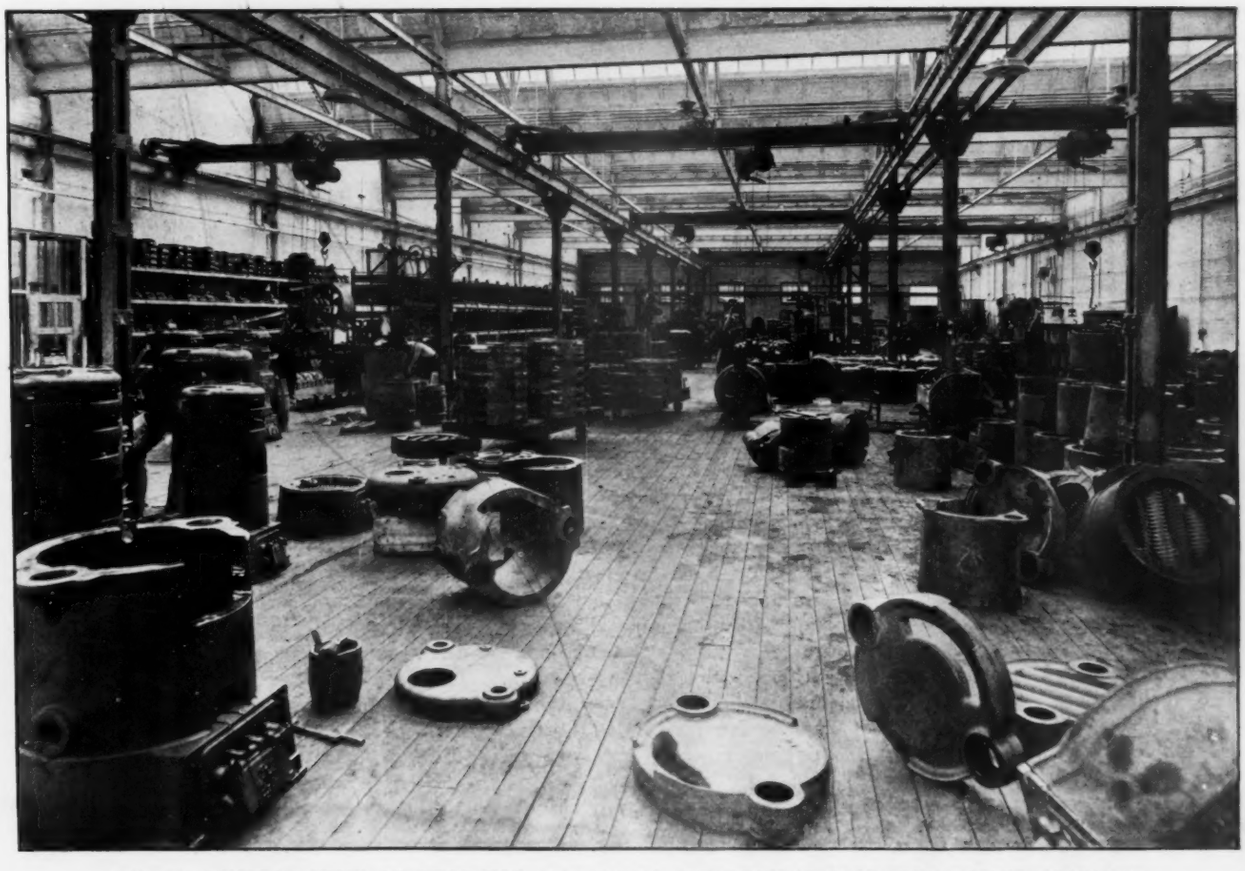


FIG. 18—GENERAL VIEW OF SHOP FOR MACHINING AND TESTING CAST IRON BOILER SECTIONS

machine, as the former practice necessitated, passes into a pit in the floor provided for this purpose. The machine is operated by an air motor, provided with control for automatically regulating the distance traversed by the roller. The crew required to operate the machine consists of one molder and two helpers who turn out from 30 to 40 molds a day. This compares favorably with the output formerly attained by hand ramming, when a molder and his helper turned out 11 molds per day. At that time, one casting was made in a flask, while each flask now contains two castings.

The accompanying illustrations show the method of making gutter castings. Fig. 13 illustrates the machine with the cope pattern mounted on the face plate. Fig. 14 shows the drag pattern fitted to the machine, while from the crane above is suspended a finished drag which just has been lifted off. Fig. 16 shows the method of operating the roller rammer.

The flasks used on this machine are cast iron, 30 x 120 inches in area and 6 inches deep; they are fitted with interchangeable bars similar to those employed in the circular sectional boiler flasks. In producing molds with the roller ramming machines, the use of gaggers and bottom boards is unnecessary. Fig. 19 shows a pile of gutters made on this machine. The Lord & Burnham Co.'s plant is provided with unusual facilities not only for receiving and shipping materials, but for transporting them about the plant. Practically all the raw materials with the exception of coke and structural steel, are received by water, since the plant is located on the east bank of the Hudson river and is provided with a dock 350 feet long and 34 feet wide. The depth alongside the dock at low water is 9 feet, which is ample to accommodate river boats and barges. Pig iron is stored in piles on the dock while for the distribution of other materials there is a telpher system erected by the Robbins Conveying Belt Co., which communicates with all parts of the plant and which carries two 2-ton monorail hoists of the Sprague type. By means of buckets of the self-dumping type, these hoists carry materials where they are needed. The foundry supplies are stored in a series of bins into which they are discharged through hatchways commanded by the monorail system. There are separate bins for coke and for the various grades of sand and clay. The monorail system extends into the cupola department and is used for bringing up pig iron and coke for each day's heat. The coke is handled in buckets, while the pig iron is loaded on trucks which are picked up by the hoists and transported to the charging floor. The trucks, which are provided with swiveled wheels, can be headed in any direction and are moved about the charging floor by means of crowbars.

The foundry is provided with a monorail system, constructed by the Coburn Trolley Track Mfg. Co., Holyoke, Mass. It communicates outside the core room with the Robbins system and in this way materials can be transferred from one system to the other. The Coburn system extends from the core room into the foundry and has branches to every part of the foundry, as well as to adjacent buildings. Three branches terminate in front of the cupola; they are so provided with switches that ladles, whether full or empty, may be shifted from one to another and thus no delays are encountered. Each day the entire heat is distributed by means of the monorail system; the bull ladles are transferred to overhead cranes at the various floors and the metal is either poured direct into the molds or into hand ladles. The five foundry cranes are floor-operated and have a capacity of two tons each.

The cupola, which is of the Colliau type furnished by the J. W. Paxson Co., Philadelphia, is designed to melt 20 tons per hour. This furnace has a spout of the tilting type and due to the facilities provided for the quick distribution of the metal, the flow seldom is interrupted during the heats. The blast is provided

FIG. 19—GREENHOUSE GUTTER CASTINGS PRODUCED ON ROLLER-RAMMING MACHINE

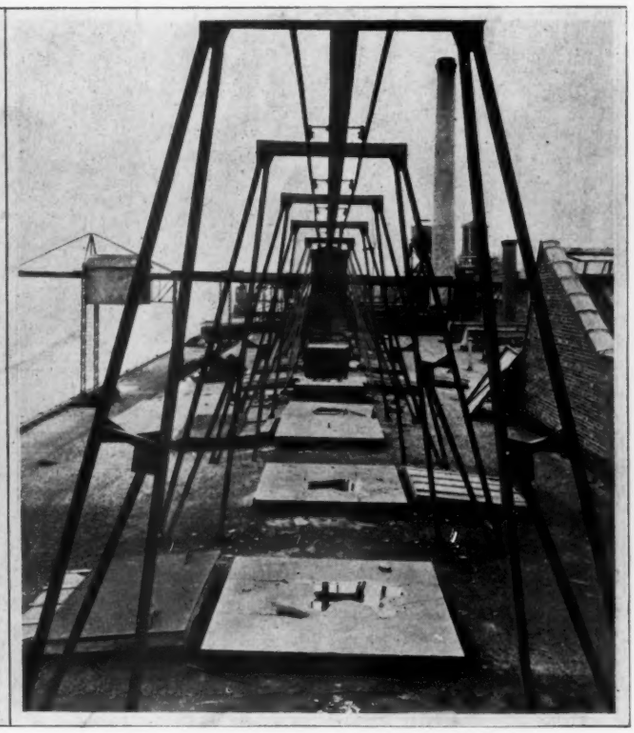


FIG. 20—OVERHEAD TROLLEY SYSTEM SHOWING METHOD OF DUMPING FOUNDRY RAW MATERIALS INTO STORAGE BINS

by a General Electric centrifugal compressor which is direct-connected to a 50-horsepower induction motor. With this type of apparatus it is unnecessary to employ a pressure gage, since it is claimed that the air pressure is kept constant by the shape of the impelling and diffusion blades of the compressor. The amount of air, however, is variable, and depends on the amount of current fed into the motor; this ratio is thought to be so exact that the corresponding figures for air and electricity are tabulated to determine the amount of air being fed into the cupola; therefore it is only necessary to read the amperage of the motor, which is done with the aid of a portable ammeter. Thus, if the iron is melting too slow, the power consumption must be increased, while if the iron is too hot the power consumption must be lowered. The results made possible by this system are said to be so exact that the foundry foreman is able, on beginning a heat, to foretell within a limit of five minutes the time when he will drop bottom.

A Modern Structure

The foundry is a comparatively new structure. It is of brick and steel construction with a saw-tooth roof; it is 145 x 188 feet, with an L, 66 x 95 feet, and has a curtain wall on the south side for extensions. The building is exceptionally well lighted and ventilated. Artificial illumination is afforded by clusters consisting of four 250-watt tungsten lamps each, which are located at a height of 19 feet above the floor; they are spaced 25 feet center to center and are provided with dome reflectors to avoid glare.

Most of the west side of the foundry, fronting the dock, is bricked off, forming the raw material storage bins, the foundry office, wash room, rest room, cupola department, etc., which occupy a space 32 x 162 feet. The nine storage bins are of various sizes and are designed to hold ample stocks of coke, core sand, fire clay, molding sand, etc.; each of these bins is 16 feet deep. The core room is located in a 34 x 95-foot space in the L. It is provided with two ovens, 10 x 20 and 13 x 20 feet, respectively, in which the cores are baked on cars. Practically all the cores are made in cast iron boxes. The heavier cores are made on two jar-ramming machines. The equipment in the core department also includes a sand-mixing machine and two overhead, hand-operated cranes. A space, 65 x 65 feet, is bricked off in the northeast corner of the foundry for the cleaning room. It is equipped with two dust collectors, a sand blast chamber, two square tumbling barrels, 28 x 37 x 68 and 37 x 45 x 68 inches, respectively, two round tumbling barrels, each 30 x 48 inches, four emery wheel stands, two portable grinders, five portable chipping hammers, etc.

Adjacent to the foundry is the boiler shop, for machining and testing boiler sections. It is 75 x 188 feet, and is of the same construction as the casting plant. It is divided into three bays, all of which are equipped with 2-ton, floor-operated traveling cranes. Adjacent to this department is another new building, 101 x 188 feet, used for the storage of boiler sections. This is of the same construction as the foundry and boiler shop. It likewise is provided with 2-ton, floor-operated, traveling cranes which can be shifted from one bay to another by means of a transfer at one end.

The plant also comprises a two-story, 20 x 50-foot, brick pattern storage; two frame storage buildings, 95 x 127 and 80 x 95 feet, respectively; a boiler house, 40 x 40 feet; power house, 25 x 42 feet; garage, 20 x 51 feet; planing mill, 85 x 208 feet, and an erecting and machine shop, 100 x 250 feet, with a wing, 50 x 100 feet. The two latter buildings comprise the greenhouse and steel sash departments.

FIG. 21—BOILER STORAGE SHOWING CRANE TRANSFER SYSTEM

Melting Points of Hard and Soft Iron

By W. J. Keep

Question:—Why does hard iron come so much hotter than soft iron, the charges of coke and iron being the same for both grades?

Answer:—Hard iron has a lower melting point than soft iron and might have a color which would indicate a higher temperature. Hard iron should melt faster than soft iron but should not be hotter. It is necessary to have hard iron much hotter than soft iron to fill the same molds and, therefore, it requires more fuel to melt it. For machinery castings or car wheels it does not need to be so hot.

Standard Specifications for the Foundryman

What the American Society for Testing Materials is Doing to Promote the Production of Better Castings

REVISED standard specifications for malleable iron castings, standard methods for the sampling and analysis of pig and cast iron for export, tentative specifications for foundry coke and proposed standard specifications for government bronze, consisting of copper, 88 per cent; tin, 10 per cent and zinc, 2 per cent, were considered at the annual meeting of the American Society for Testing Materials, held at Atlantic City, June 22 to 26.

The committee on Standard Specifications for Cast Iron and Finished Castings, of which Dr. Richard Moldenke is chairman, in presenting its report on the revised standard specifications for malleable iron castings, stated that another change in these standards undoubtedly will be made which will involve specific standard specifications for malleable castings intended for definite classes of work. It was pointed out that malleable iron car castings must be soft enough to permit riveting, whereas conveyor chain links must be strong and inelastic. While these are diametrically opposite requirements, such castings usually are made from the same heats in many establishments attempting to turn out work to specifications. In presenting its revised standard, which was submitted to letter ballot for adoption the members of the committee ventured the opinion that specific specifications for the different classes of malleable iron castings, sooner or later, will have to be adopted.

Pig and Cast Iron

Mention was made of the progress in the formation of a sub-committee on standard specifications for soil pipe and fittings. Several conferences have been held with those most interested, but sufficient progress had not been made to warrant the presentation of a definite report at this meeting. The revision of the existing Standard Specification for Car Wheels has been referred to a sub-committee for early attention.

The Standard Methods of Sampling and Analysis of Pig and Cast Iron for Export were prepared by W. F. Hillebrand of the United States Bureau of Standards and have received the enthusiastic approval of leading chemists and metallurgists as representing the best practice of this country. In the adoption of these standards, it is understood that if they can be improved by the European members of the International Association for Testing Materials, the American members will co-operate with them to make their practice conform in every way to the most advanced thought of the world.

Specifications for Coke

The Committee on Standard Specifications for Coke limited its report to this fuel for foundry purposes and the specifications, which are merely tentative, were presented to invite criticisms, that should be directed preferably before Jan. 1, 1916, to A. C. Fieldner, secretary, United States Bureau of Mines, Pittsburgh. In its deliberation, the committee considered the methods of sampling, analysis and testing, and the form of the specifications, with special reference to the condition under which foundry coke is sold.

It was recognized that a rational and accurate method of sampling coke should involve taking regular increments while loading or unloading the car, so as to secure several hundred pounds of gross sample, which then should be reduced by crushing, mixing and quartering to a convenient size for transportation to the laboratory. This method of sampling, however, presents several practical difficulties, since the crushing and reduction of several hundred pounds necessitates the use of mechanical crushers, seldom available at the point of sampling; also, sampling while unloading the coke is feasible only when the coke is purchased under a system of premiums and penalties, which the trade is not willing to accept at this time.

Since the only acceptable form of specification is one based on maximum and minimum limits of chemical composition with the privilege of rejection when these limits are exceeded, it seemed essential to take the sample from the exposed surface of the car so that the car could be rejected before unloading in case the coke did not conform to the specifications.

The committee recognized that a minimum gross sample of two pecks of walnut size is too small to be strictly representative; however, in view of the fact that a sample taken from the top of a car is only approximately representative of all the coke, it seemed unnecessary to impose the extra expense entailed by crushing down a larger sample.

Satisfactory progress has been made toward the adoption of uniform standard methods of analyzing coke, by co-operation with the joint committee on coal analysis of the American Chemical Society and the American Society for Testing Materials, and the committee on coke analysis of the American Foundrymen's Association, and it is expected that uniform standard methods will be available for incorporation in coke specifications by the end of another year.

The committee has given considerable attention to the various physical tests of coke, such as crushing strength, shatter test, porosity, specific gravity, etc., and as a result of this investigation concludes that the compressive-strength test as determined on 1-inch cubes is worthless as a means of comparing different cokes, and that in general the relation between results of physical tests of coke and its value in practical use is too indefinite to include quantitative expressions of physical properties in standard specifications at present.

Government Bronze

The Committee on Non-ferrous Metals and Alloys presented standard specifications for the alloy: Copper, 88 per cent; tin, 10 per cent and zinc, 2 per cent. The sub-committee on Pure Metals in Ingot Form has under consideration a revision of the specifications for spelter, and specifications for tin were under consideration at the outbreak of the European war. The sub-committee on White Metals is working on lead and tin base babbits. Five or six grades are under consideration and the methods of sampling, analysis and testing are being discussed. The determination of the elastic limit of alloys in tension and compression has been considered as well as the oxidation of bearing metals and some test to show it accurately. The various standard specifications, including the revised and tentative, are given on the following pages.

S. Fair & Son., Inc., Saginaw, Mich., has placed a contract with the Snyder Electric Furnace Co., Chicago, for the installation of an electric furnace which will have an output of eight tons of refined steel in 24 hours. The furnace will be operated on cold stock and vanadium steel will be manufactured.

Specifications for Malleable Iron Castings[1]

The castings shall be made from iron melted in either an air, open hearth or electric furnace.

Tension test specimens shall conform to the following minimum requirements as to tensile properties:

Tensile strength, lb. per sq. in.... 38,000
Elongation in 2 in., per cent..... 5

Transverse test specimens, tested with the cope side up on supports 12 inches apart, pressure being applied at the center, shall conform to the following requirements as to transverse properties:

Thickness of specimen, inch	Minimum load applied at center, pounds	Minimum deflection at center, inches
½	900	1.25
⅝	1,400	1.00
¾	2,000	0.75

In addition to the tension and transverse tests, the inspector representing the purchaser may satisfy himself of the suitability of the iron used for the castings by breaking a reasonable number of castings before annealing to examine for excessive mottling or graphite spots. In the case of castings of special design or importance, he may also require test lugs of a size proportional to the thickness of the casting, but not exceeding ⅝ by ¾ inch in section. At least one of these lugs shall be left on the casting for final inspection.

Tension test specimens shall be of the form and dimensions shown in the accompanying illustration. Transverse test specimens shall be 14 inches in length by 1 inch in width and either ½, ⅝ or ¾ inch in thickness. The thickness of the specimen selected shall be in proportion to the thickness of the casting which it represents.

Two tension and two transverse test specimens shall be cast in each mold with risers of sufficient height at each end to secure sound bars. All specimens shall be cast without chills, and with ends perfectly free in the mold.

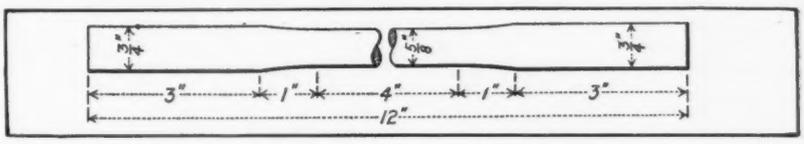
Four molds shall be poured to represent each melt. When the entire melt is used for castings which are subject to these specifications, two molds shall be poured within five minutes after tapping into the first ladle, and two molds from the last iron of the melt. When only part of the melt is required for such castings, two molds shall be poured from the first ladle of iron used and two molds after the required iron has been tapped.

The molds shall be suitably stamped to identify the specimens.

The test specimens from one mold from the first and one mold from the last of the melt shall be annealed in the hottest part of the annealing oven, and the remaining specimens shall be annealed in the coldest part.

One tension and one transverse test specimen from each of the four molds representing a melt shall be selected for test. The remaining specimens shall be reserved, and shall be tested in case of failure to conform to the requirements specified.

If more than one tension or transverse test specimen from each of the two molds annealed in the two points in the oven fail to meet the requirements as to tensile or transverse properties, the castings from that melt will be rejected.



TENSILE TEST SPECIMEN FOR MALLEABLE IRON

Workmanship and Finish

The castings shall substantially conform to the sizes and shapes of the patterns, and shall be made in a workmanlike manner. A variation of $\frac{3}{32}$ inch per foot will be permitted.

The castings shall be free from blemishes, scale and shrinkage cracks.

The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the castings ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the castings are being furnished in accordance with these specifications. All tests and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

[1]These specifications are intended for general use, and in particular for railroad malleable iron castings, for which purpose they will be designated when additional specifications for other classes of malleable iron castings shall be adopted.

Sampling Pig and Cast Iron for Export Use

Pig Iron.—One pig shall be selected at random from each four tons of iron and ten such pigs (representing 40 tons of iron) shall constitute a unit for sampling, see note No. 1). The surface of each pig shall be cleansed with a stiff wire brush or in any manner that will remove all loose sand without introducing deleterious matter.

The skin, down to clean metal, shall then be removed with an emery wheel at the center of the upper face of each pig and the surface carefully brushed off.

Drillings shall be taken with a ¼-inch twist drill, from top to bottom of each pig, starting from the center of the cleared space (see note No. 2) and stopping when the point of the drill appears below. One hole only shall be bored in each pig.

Suitable precautions must be taken to prevent the escape of fine particles during the drilling. To this end it has been suggested that a disc of clean sheet metal shall be clamped upon the pig after the skin has been removed. This disk shall have a hole in its center just large enough to receive the drill. Most of the drillings will then accumulate on top of the disk and can be brushed off after the drill is withdrawn. The pig is then to be turned bottom side up over any suitable receptacle for collecting what may have remained in the drill hole.

It is understood that three special cylindrical standard test bars, 1.2 inches in diameter, will be cast in sand from each heat at the beginning and again at the end of the pouring.

One bar from each set having been broken, one end of each next the fracture shall be thoroughly cleaned and the outer skin removed for a sufficient distance from the fracture and down to clean metal. Chips shall then be taken by means of a lathe or milling machine across the whole face of the bar and until not less than 100 grain weight has been collected. The same amount must be taken from each bar. The bar must be so clamped as to permit the attachment or use of any suitable device for collecting every part of the sample and the machine must be run slowly enough to reduce to a minimum the danger of loss of fine particles.

The entire unit shall be weighed and then sifted on tight-fitting sieves (with cover) having 80 (and if need be 120) meshes to the linear inch (approximately 900 and 2,500 per square centimeter). The finer sieve need be used only in case the particles passing the coarser sieve are not sufficiently uniform in size and shape to meet the requirements of the treatment that follows.

The two (or three) portions so obtained shall be separately weighed. Each one shall then be thoroughly mixed without any loss of material and divided by weight into two (or three) exactly equal portions, each of which shall be placed in a clean, glass-stoppered bottle or other receptacle of suitable material and appropriately labeled. Of the three sets of the subdivided samples, one shall be retained by the works, one sent to the purchaser's chemist and the third reserved.

Before weighing out for analysis, the contents of each bottle shall be thoroughly mixed and each portion used for analysis shall be made up of the two (or three) partial samples in the same proportion which they bear to the gross sample. Thus, if the gross sample, weighing, say, 500 grains, has been separated into portions weighing 400, 80 and 20 grains, the amounts of each that must be weighed to yield a 2-grain portion for analysis are 1.6 grains, 0.32 grain and 0.08 grain, respectively (see note No. 3.)

NOTES

1.—This is a suggestion that was made at the meeting of the Committee A-3 of the American Society for Testing Materials in Atlantic City, in opposition to that of making the carload the unit for sampling. On account of the great difference in the size of cars in this and European countries, it was thought that some definite weight (such as 40 tons) should be adopted. One correspondent has suggested that each pig taken for sampling might be made to represent a greater weight than four tons.

2.—Concerning this point the greatest difference of opinion has manifested itself. The common practice in the United States is to break the pig and to drill horizontally into it about half way between one side and the center. The advantage claimed for this procedure is that it involves less danger of contamination by sand than the one proposed.

However, it seemed to the Committee A-3 that vertical drilling through the bar is more certain to yield a fair sample for sulphur than horizontal drilling. The recommendation of a single vertical hole is made with full realization that sulphur segregates in the upper central part of the pig and that a single hole may not give a very true sample. What deviation there may be is, however, likely to be in favor of the purchaser by showing a maximum for sulphur.

3.—This is the procedure recommended by Bauer & Deiss of the Material-Prufungs-Amt. as the only one certain to give in general practice analysis portions of uniform composition. Bauer & Deiss do not, however, provide for dividing the original portions obtained by sifting into two or more sets, a procedure which seems to be necessary in commercial transactions.

No objection has been raised to the principle of this procedure by any American chemist who has been consulted, but some prefer as less cumbersome the procedure described by Shimer (*Trans. Am. Inst. Mining Eng.*, 1886). This does not involve sifting of the gross sample, but instead thorough mixing after grinding, moistening of the whole with a certain amount of alcohol followed by a further thorough mixing on glazed paper. Before evaporation of all the alcohol the portions needed for analysis are to be weighed out, allowed to dry and then weighed again.

The Shimer method affords excellent results in some hands, but it would seem as if greater opportunity were afforded for different analysis to obtain different results than by the method of Bauer & Deiss recommended. This belief is confirmed by some chemists among those consulted, who expressly condemn the Shimer method in comparison with that of Bauer & Diess.

Specifications for Government Bronze

These specifications cover the alloy commercially known as government bronze, admiralty gunmetal, gunmetal, or 88-10-2 mixture, when used in castings.

It is recommended that this alloy shall not be used where castings are subjected to a

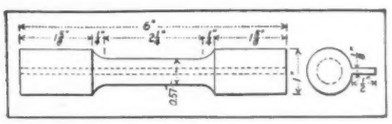


FIG. 1—GOVERNMENT BRONZE TEST BAR

temperature exceeding 260 degrees Cent. (500 degrees Fahr.).

The alloy may be made by any approved method.

The alloy shall conform to the following requirements as to chemical composition:

	Per cent
Copper	87-89
Tin	8-11
Zinc	1- 3

The sample for chemical analysis may be taken either by sawing, drilling or milling the castings or tension test specimen and shall represent the average cross-section of the piece.

The saw, drill, cutter or other tool used shall be thoroughly cleaned. No lubricant shall be used in the operation and the saw dust or metal chips shall be carefully treated with a magnet to remove any particles of iron derived from the tools.

The alloy shall conform to the following minimum requirements as to tensile properties:

Tensile strength, lb. per sq. in.... 33,000
Elongation in 2 inch, per cent.... 14

Two test bars of the form and dimensions shown in Fig. 1, shall be an integral part of large castings, or cast separately in the case of small castings to represent a lot or melt and shall be molded in a manner similar to the castings which they represent. If the castings are heat-treated, the test bars representing such castings shall be similarly heat-treated.

The manufacturer and purchaser shall agree whether test bars can be attached to castings, on the location of the bars on the castings, on the castings to which bars are to be attached, and on the method of casting unattached bars. Unless otherwise agreed upon, the minimum lot shall be considered as 500 pounds.

The tension test specimen, turned down from the test bar shown in Fig. 1, shall be of the form and dimensions shown in Fig. 2.

Two tension tests shall be made from each lot or melt.

If any test specimen shows defective machining or develops flaws, it may be discarded; in which case the manufacturer and the purchaser or his representative shall agree

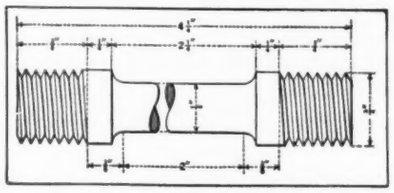


FIG. 2—TEST SPECIMEN TURNED DOWN FROM TEST BAR

upon the selection of another specimen in its stead.

Investigation of Claims

If the purchaser's tests show that the material does not conform to the requirements, the manufacturer shall have the opportunity to inspect the material and each party shall select a sample for retest. If the results do not agree each shall select a sample to be sent to a mutually agreeable umpire, whose decision shall be final. The costs of retests shall be paid by the loser.

Tentative Specifications for Foundry Coke

Each carload, or its equivalent, shall be considered as a unit.

The sample shall be taken from the exposed surface of the car, by knocking off with a hammer a piece approximately the size of a walnut, at regular intervals of 18 inches along three lines running from one end of the car to the other. One of these lines shall pass through the center of the car and the other two lines shall be 2 feet from the respective sides of the car.

The intervals of sampling along the three lines may be measured by using a hammer with a handle 18 inches long, breaking off a piece of coke the size of a walnut at each point where the head of the hammer rests, regardless of the appearance of the particular piece that happens to occur under the head of the hammer.

The total quantity of sample collected in the foregoing manner shall not be less than two pecks.

The entire gross sample shall be crushed to pass through a screen having four meshes to the linear inch, under such conditions as shall prevent loss or the accidental admixture of foreign matter. The crushing shall be done mechanically with a jaw crusher, or by hand on an iron or steel plate by impact of an iron or steel tamping bar, hammer or sledge, avoiding all rubbing action, otherwise the ash content of the sample will be materially increased by the addition of iron from the crushing apparatus, even though hardened steel or iron is used.

After all the gross sample has been passed through the four-mesh screen, it shall be mixed on a strong, closely-woven cloth about 5 feet square by raising successively the four sides of the cloth, thus rolling the sample about until thoroughly mixed. The four corners of the cloth shall then be gathered up, and the sample shall be formed in a conical pile and reduced in quantity by quartering as follows:

The cone shall be flattened, its apex being pressed down so that each quarter contains the material originally in it. The flattened mass shall then be divided into four equal quarters. The diagonally opposite quarters shall then be removed and discarded and the space that they occupied brushed clean. The two remaining quarters shall be successively mixed, coned and quartered on the cloth as before, until two opposite quarters shall weigh not less than five pounds, which shall then be placed in a suitable container for transportation to the laboratory. In case duplicate laboratory samples are desired, the rejected portions of the original four-mesh sample shall be combined, mixed and quartered down to the specifications of a similar five-pound sample.

The sample prepared by the foregoing method may, at the option of the purchaser, be used for an approximate moisture determination. In such cases the gross sample shall be immediately crushed and reduced to the five-pound laboratory sample as rapidly as possible, to minimize the loss of moisture. The container for shipment to the laboratory shall be moisture-tight. Since the sample obtained by this method will usually show less than the true moisture content of the gross sample, the purchaser shall have the privilege of special moisture sample as hereinafter provided, if the standard sample shows more than 3 per cent moisture.

In such cases where the moisture content is an important consideration, the entire gross sample of not less than two pecks, of walnut size, taken in the manner described, shall be placed, at once after collection, in a moisture-tight container for transportation to the laboratory. The car shall be weighed at the time the special moisture sample is collected.

In case of disagreement between buyer and seller, an independent chemist, mutually agreed upon, shall be employed to sample and analyze the coke, the cost to be borne by the party at fault.

The resample shall be taken and prepared as prescribed in the foregoing sections, except that the minimum quantity of gross sample

shall be not less than one bushel in volume, taken at intervals of 18 inches on six equidistant lines parallel to the side of the car.

Chemical Analysis

The sample received at the laboratory shall be prepared for analysis, and the percentage of moisture, volatile matter, fixed carbon, ash, and sulphur shall be determined as specified in the "Standard Methods of Analyzing Coke," which are given as an addendum to these specifications.[1]

The dry coke shall not exceed the following limits in chemical composition:

	Per cent
Volatile matter .....not over	2
Fixed carbon .....not under	86
Ash .....not over	12
Sulphur .....not over	1

In case the original standard sample was taken in accordance with the method recommended and showed more than 0.03 per cent moisture, the purchaser shall have the option of taking a special moisture sample, and of deducting the moisture found in excess of 3 per cent, from the weight of coke found on reweighing the car at the time the special moisture sample was taken.

In case the original standard sample was taken with special regard to moisture, the purchaser shall have the option of deducting the moisture in excess of 3 per cent from the weight of coke, provided that the car was weighed at the time of sampling.

Coke which fails to conform to the limits of the chemical composition given will be rejected, and the seller shall be notified within five working days from the date of sampling.

[1]The "Standard Methods of Analyzing Coke" referred to are not appended to these tentative specifications. They are under joint consideration of committees from the American Chemical Society, the American Foundrymen's Association, and the American Society for Testing Materials.

When the Ladle Chain Broke

By Leo Forrester

I WAS working on the floor in the Oliver Whitney foundry at the time the following happened. I had learned my trade there and stayed on, for it was an easy berth and the pay was good. Old Man Whitney was one of the finest men you could meet in a bunch of Sundays and a prince of a man to work for. There wasn't a man in the foundry from the cupola tender to the Dago kid who helped in the core room who didn't respect and think kindly of him. He was never too busy but that he had time to stop and exchange a word with us when he came through the foundry, but was always willing to listen to any grievance. The only pity is that there are not more like him.

The Old Man loved the foundry, for he had followed the business from boyhood and had worked his way up from the ranks. He was the father of a little lad, probably nine years of age,—a bright little chap who was certainly a chip of the old block. He had the Old Man's way of looking you straight in the eye as though there wasn't such a thing as deceit and dishonesty; and when he looked at you with his confident blue eyes, if there was a mean thought in your mind, your conscience was going to remind you of it.

The Youthful Boss

We used to see quite a lot of the little fellow, for almost every night he would stop in after school to watch us pour-off. The foundry had a great fascination for him. He liked to watch the molten iron flow into the flasks like a stream of liquid fire. The men in the foundry liked the lad, but couldn't resist kidding him, calling him "Boss"; but the boy was every bit as good-natured as the Old Man and only grinned at this.

The Old Man was mighty proud of the boy. We knew how the Old Man loved the foundry and how pleased he was that his son was taking an interest in the work, and just to help matters along in the right track we told him about molds and cores and how the iron was made to form certain shaped castings. While the boy maybe didn't realize it, we were giving him the rudiments of iron molding that was going to be of benefit to him later.

There was a young fellow in the foundry named Bryce Morrison, who had charge of the cards and red tape connected with the stock order and invoice system. He was as quick as a cat when it came to detail and was on the job every minute. He was working for promotion and when it came he deserved it. I had seen from the first that he was too good a man to be dubbing away on the clerk's job, and I guess the Old Man thought so too. One morning he called Bryce into the main office.

"Bryce," he said, "I'm going to ask you to keep an eye on Harry when he is in the foundry. I know what the foundry is and how easily an accident can happen. It's all well enough that the boy should go there, for I want him to get as close to the game as he can and I'm an advocate of the influence of early training. I want the boy to grow up and know iron molding for the big, man's-size job that it is. That's why I permit him to go into the foundry whenever he cares to. However, there are times when I am uneasy about him for fear of a possible accident. I won't be, though, if you'll promise to look out for him. May I depend on you, Bryce?"

Young Morrison was a conscientious fellow anyway and the Old Man's confidence in him made a deep impression.

"Mr. Whitney, I thank you for placing so great a confidence in me. You may be assured that I shall do everything I can to look out for the boy when he is in the foundry. I give you my word, sir."

"Very well, Bryce, I thank you."

Bryce kept a sharp watch over the lad after that. I could see that there was slim chance of the boy getting mixed up in any kind of an accident unless of a most unforeseen nature. But Fate plays some mighty queer pranks sometimes, as in this instance.

Pouring a Big Casting

We were completing a large order for a local gas engine company which included several big engine bases. The largest of these would take in the neighborhood of 8,000 pounds of metal, which was a pretty big one-mold pour for us. Harry came in that night, as he wanted to see us pour the big mold. Bryce took him in hand as usual and told him to stand at one side, where he would be entirely out of the way of harm if the big mold exploded.

We poured out of the biggest ladle we had, which of course was carried from the cupola to the mold by the crane. I remember watching the crane man as he lowered it over the mold. Then I gave a sharp cry of warning, for even as I looked I saw one of the links in the chain open and I knew that in an instant more the huge ladle of molten iron would be dashed to the floor.

Foundrymen realize how closely they work to danger and depend on quickness of action to get out of harm's way in an emergency such as this. As I cried out a warning every man sprang back. It was none too soon. A second later would have been too late. The chain gave way entirely and the huge ladle of molten iron tipped sideways, the iron running out in a fiery stream.

The air was dense with smoke and I could see only those closest to me, but I felt that all had gotten safely

out of the way. I was just beginning to experience that feeling of thankfulness that comes over a man in such instances when it would seem that human lives had been spared by a miracle. Then I heard a shrill, terrified scream and turned, just as Bryce dashed by me, his face white as death. For the moment I had forgotten about the boy. Out somewhere in the smoke the lad had been trapped by the fiery flow as it spread out on the floor.

Luckily, though, the lad was standing on a low pile of sand and had not been reached by the molten iron, though it had entirely surrounded him, leaving but a foot or two of standing space. He was terrified, as well he might be with the hissing, smoking iron all about him. He screamed for help and we knew that if someone didn't reach him quickly he would make a step that would inflict serious burns and possibly cripple him for life.

Bryce Rescues the Boy

"Stand still, Harry," Bryce called out. "Don't move." And then almost before we could define his intention he stepped back a few yards, made a run, and leaped over the ten feet of molten iron. It was a big jump and to fall short even a few inches would mean a burned foot that would leave him with a scar the rest of his life.

Bryce told me afterwards that it wasn't a terribly big jump for him as he had had lots of that work at school; what presented the biggest difficulty to him was to gage the distance so that he would land on the limited footing space and be able to grab the lad and keep from knocking him over. But he did it. I think yet that it was the finest piece of clear-headedness that I have ever seen.

Bryce held the boy safely while the rest of us got busy and covered the iron with sand. Then he carried the lad across and told him he had better run in to his father. You know how a man feels in a moment of that kind? Well, we wanted to slap Bryce on the back and shake his hand and call him a hero and all that, but he wouldn't stand for it. "I simply did what the Old Man expected of me; I would have been a coward had I done less." But all the same, I think he appreciated our looking at the matter as we did.

Of course the Old Man heard the story and sent for Bryce the following morning. Harry was in the office, too, looking about as tickled as a nine-year-old kid can when he has a surprise in his active young mind. "Bryce," the Old Man said kindly, "I thank you from the bottom of my heart for what you did last night. Harry does, too, though of course he doesn't appreciate what you have done for him so much as he will when he grows older. He has a little present for you, Bryce, that he's mighty anxious to give you, as you can see by his actions."

The little lad was taking a small package out of his pocket, his face flushed with the pleasure of giving. He was fairly dancing, he was that pleased. "Open it quick!" he begged.

Well, the gift the lad had bought for Bryce was the reddest thing in the way of a silk handkerchief you could imagine. It was so red it hurt your eyes to look at it. But it was just the kind of a thing that would appeals to a nine-year-old boy, and he felt that he was giving Bryce the finest present that a fellow ever had. Bryce looked up to see the Old Man watching him with a twinkle in his eye.

"I told Harry he could buy you just what he liked, and the handkerchief was what he picked out."

"I certainly thank the boy, and you, too, sir. I shall prize it all my life, and none the less so, sir, because it—it is so red."

At that the Old Man laughed heartily. "I guess Harry picked out the reddest one he could find, that's true. But the boy's heart is behind it—that is the main point, Bryce.

"And now I have a proposition to make you. I need a man here in the office who has a good, general knowledge of foundry practice, to assist my present purchasing agent. This man leaves the first of the year, and I am giving you the opportunity to prepare yourself to step into his position. I feel that you can make good on the job. How do you feel about it?"

"Mr. Whitney, I——I call that a splendid chance!"

"Then I can expect you on the job tomorrow?"

Bryce looked at his watch. "It's just 9:30, sir. I can go home and get into my other clothes and be back by 10:30, and start today. Yes, I can even beat that 15 minutes if I rush."

"Very well," the Old Man said kindly, pressing a buzzer. The purchasing agent came in and Bryce was introduced to him.

"This is the young man who will assist you," said the Old Man. "Do everything you can to help him along. He will be ready to take up his new work at 10:15 today."

Blow-Holes in a Casting

By W. J. Keep

Question:—I recently made a casting 30 inches long, 18 inches wide and ¼ inch thick, which was half round. The edges were molded down and four pop gates were placed on top of the casting. This left the green sand core in the drag. The casting has a horizontal flange on each side, 1½ inch wide and ¼ inch thick. These flanges are machined and the defects in the casting consist of a row of blow-holes in each flange. The mold was faced with plumbago, and was sprayed with kerosene. Unfortunately, our coke is not a very good fuel and we would like to know whether the kerosene or the sulphur in the coke caused the difficulty. The holes were about $\frac{1}{16}$ inch deep, as large as a dime, and were of a bluish tint.

Answer:—The amount of oil that you use could do no harm and probably the sulphur in your coke cannot be attributed to this difficulty. I would suggest that you change the gating, letting the iron rise toward the round, center part where you could place a riser. Your difficulty is due to the fact that your iron entered the flanges so fast that it caught the gases before they could escape. If you intend to leave the gates as indicated in your inquiry, vent thoroughly over the flanges. You can remedy this difficulty by changing the gates and don't blame everything on the sulphur. We would suggest that you purchase the best coke that you can obtain and then by properly gating, the use of risers and venting, permit the gas to escape. The blue color on the inside of the holes undoubtedly is due to the steam of the gases.

To Build Addition

The Sterling Wheelbarrow Co., West Allis, Wis., manufacturer of steel flasks and other foundry accessories, is enjoying such a heavy demand for its product that it will erect an extension to its flask department which will increase the floor area 7,500 square feet. Last fall an addition of this size was completed, but this has proved inadequate to the company's needs. The total business placed with the company during May exceeded all previous records. All of the orders were domestic, no foreign business having been included.

The Black Products Co., Chicago, manufacturer of core compounds, announces it has established grinding and manufacturing plants at Youngstown, O., and St. Louis. These additional facilities, with the production from its Chicago plant, guarantee good service.

Where's That Pattern? and How to Locate It

Details of a Practical Pattern Storage System Which Has Worked to Advantage in one Large Shop

By H A Russell

KEEPING track of more than 30,000 patterns and core boxes for a gray iron foundry might seem like a fairly good-sized job, especially when a certain percentage of the patterns are used in two or more places on separate groups of machines, this being made possible by either the change in cores or the addition or omission of one or more loose parts. To the regular man, in charge of the pattern storage department, the work, of course, is simplified by daily contact with the various patterns and familiarity with the product of the plant. To have the records in such shape, however, that anyone in authority in the plant (in case of absolute necessity only) could go to the storage department and pick out any pattern with a reasonable amount of certainty that the correct pattern had been selected, or if the pattern were not in its proper place, would be able to instantly locate it elsewhere in the factory, might seem to imply a lot of hard work. And to get this system started will entail considerable work and patience, but the results more than justify the labor involved. The pattern man, of course, is responsible for the patterns, and this system was planned to make him responsible to the fullest extent.

The entire floor in the warehouse opens only to two keys; these are carried by the pattern man and watchman, so if the pattern cannot be located the pattern man knows that the fault is his, as the watchman's instructions would prevent him from having anything to do with the patterns.

By referring to the illustration of the pattern rack, Fig. 1, it will be noted that at the top a board is painted white and lettered in black, *C-1*; on the corner post supporting the shelves close to the floor is painted a figure *1*; just above the first shelf, *2*, etc. At the opposite end of the rack there is another projecting board with *C-1* painted on it, and the corner is numbered *1*, *2*, *3*, etc. All racks in this row will be in the *C* division, and numbered from *1* up, as high as necessary. The majority of the racks have five shelves and the floor gives an additional space for the heavier patterns. The distance to the first shelf from the floor should be governed by the size and weight of the patterns to be stored there. These same conditions will, of course, regulate the distance between the shelves, but 10 inches between shelves and 24 inches from the floor to the first shelf answers our purpose. To support the shelves, small angles, 1 x 1 x 3/16-inch, can be used. This method of construction allows the greatest amount of daylight to enter between the shelves from the ends of the racks. On the top of the angles a small strip of wood, 1 inch thick by 1½ inches high, should be placed; this permits nailing the boards composing the shelves.

Some patterns cannot be placed on shelves; in this instance we use floor space only, painting a white border around the desired location and suspending from the overhead girders a board with the proper division letter and number on it. There was still another group of patterns, such as boiler fronts or similar patterns, with thin sections and covering con-

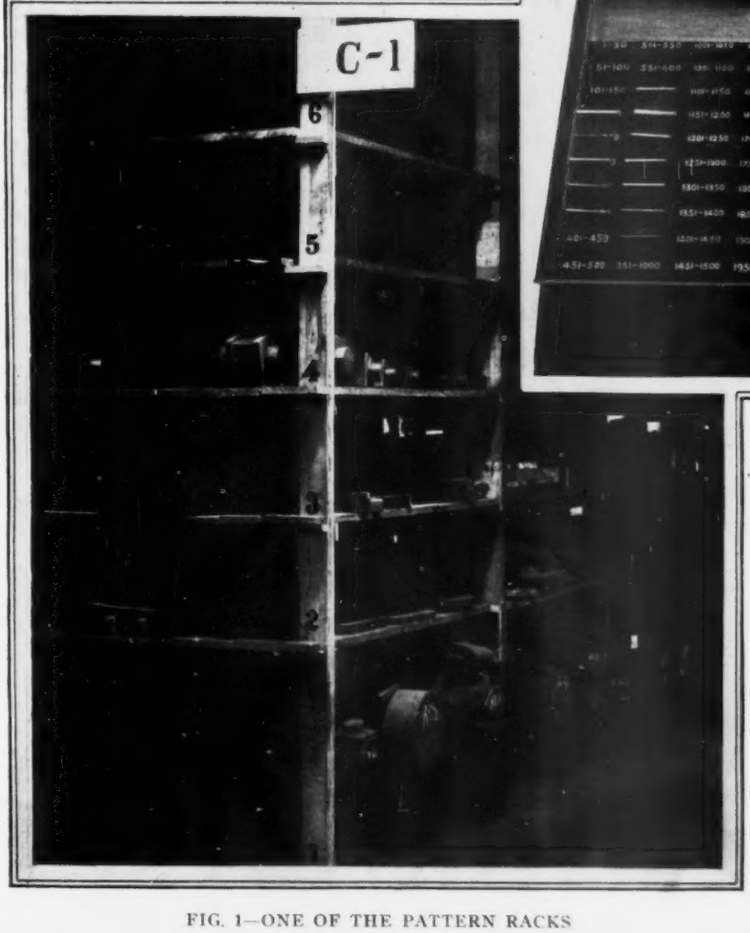


FIG. 1—ONE OF THE PATTERN RACKS

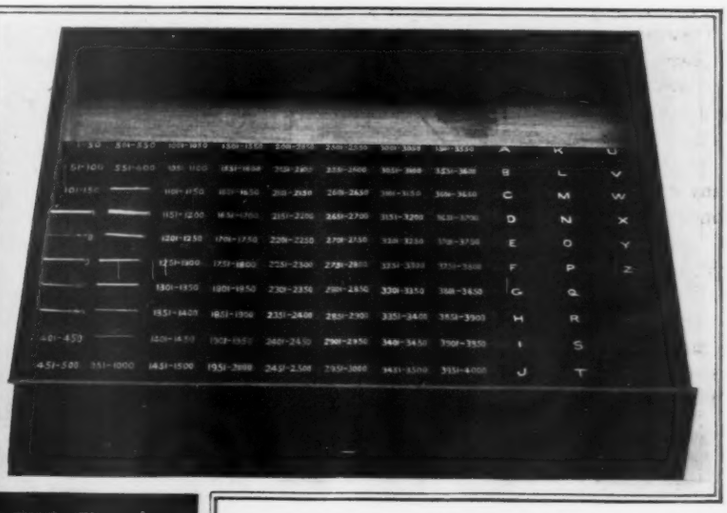


FIG. 2—ONE OF THE CARD INDEX DESK DRAWERS

PATTERN RECORD

No. and Letter S419 Core Box

Casting Name Gear Wheel — Section Letter F — Foundry

Machine Name Separator — Rack Number 3 — 1

Material in Pattern—Wood Iron ✓ Brass Aluminum — Shelf Number 4 — 4

Pat. Gated—~~Yes~~ No. No. of Pieces 1 / No. of Core Boxes 1 / Material—Wood Iron ✓

Date original Pat. was made May 20th 1914 Date changed Dec. 10th 1914

Date changed 191 " " 191

Grey Iron

If original No. and Letter changed, state new No. and Letter

If Core Box used elsewhere, state Pat. No. and Letter S420

If pattern takes stock core, so state

Date April 15th 1915 Signed F. W. K.

FIG. 3—PATTERN RECORD CARD

Record of Patterns shipped to other Foundries

Shipping Date	Receiving Date

FIG. 4—REVERSE SIDE OF PATTERN RECORD CARD

siderable area, and we found that the easiest way to store these was to make a sufficient number of narrow stalls, giving this division a designating letter, and numbering the stall horizontally instead of vertically, as with the shelves.

Pattern Record Cards

We will now consider recording the patterns and core boxes on the 4 x 6-inch pattern record cards. These cards are kept in standard steel card drawers. The card illustrated in Fig. 3 shows that pattern S-419 will be found in section *F*, rack *3*, shelf *4*, and that the core box is in the foundry on rack *1*, shelf *4*. Many of the core boxes are kept in the foundry near the core ovens, as they are practically all iron, and as the chances of being damaged there by a possible fire is very slight, we arranged our system so that we would not have to carry these heavy core boxes back and forth between the pattern storage and the foundry. Of course, where the core boxes are kept in the pattern storage, they are carefully indexed.

Some of the different classes of machinery require over 500 patterns. We divided the index into our regular 17 classifications, using only center guides, blue in color, one-third cut; we then subdivided the different classes according to the machines, using salmon colored cards, one-third cut, end cards only; we again subdivided these divisions into groups of 50, using buff colored index cards one-fifth cut, and we numbered these cards one to 50, 51 to 100, 101 to 150. The more care taken in indexing, the more time saved in locating the proper card, and securing the pattern and core boxes.

No pattern is placed on a rack until it is properly indexed. We found that in quite a few instances the foundry had different names for castings than those by which the office knew them, so in writing up the cards we used the names shown in the repair lists, or where the parts were new and consequently not listed, the proper descriptive name was obtained from the production department. As it is necessary, at times, to change a pattern, for example to strengthen it, we note the date the change was made. This information is often of service to the repair department. At other times the change in the pattern is such that a new designating letter and number is considered advisable. The old number is recorded on the card so as to assist the repair department, and frequently this is of considerable value to the patternmakers. On the opposite side of the card the pattern keeper can have a record of all patterns leaving the factory; this applies only to patterns for steel or malleable castings which are purchased elsewhere, and this record is more of a memorandum for the pattern keeper's convenience than anything else. A more complete record is kept in the purchasing department.

Pat. No. and Letter S49

Jan. Feb. Mch. Apr.

May ✓ June July Aug.

Sept. Oct. Nov. Dec.

1915 ✓ 1916 1917 1918 1919

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20 ✓	21
22	23	24	25	26	27	28
29	30	31				

Foundry Pat. Dept. ✓ H. E.

Tool Room Drawing Room

FIG. 5—OUT-CARD

Where the Cards are Kept

Fig. 2 shows a desk drawer, the interior of which is divided into a number of vertical pigeon holes. The desk in which this drawer is kept, and the card index cases, are placed in about the center of the pattern storage department. The illustration shows that the drawer is somewhat deeper than appears necessary; it was made in this way, however, so that it could be pulled out far enough so that the last pigeon hole would be out past the edge of the desk, without the drawer getting out of position. We use, in conjunction with this drawer, what we call *out-cards*, Fig. 5, which are 1⅞ inches wide by 3½ inches long. When a pattern is removed from its own particular rack and shelf one of these cards is filled in, the only writing being the letter and number, the full description being on the pattern record card. Then by checking the day, month and year, and the department or individual to whom the pattern was delivered, the record of this particular pattern is complete.

Let us suppose that the pattern sent out was number *S-49;* the card would then be dropped into the pigeon hole numbered *1-50*, or if *S* only, would be dropped into *S* pigeon hole, in the alphabetical division in the extreme right hand side of the drawer. No matter how long the pattern is away, the *out-card* is kept in its proper pigeon hole, and when the pattern is placed on its shelf again, the *out-card* is destroyed. When there is no *out-card*, the pattern, if for a gray iron casting, should be on

X249	Grain Drill		
Name of Casting	Grain & Fertilizer Spout		
Material in Casting	Malleable		
Gates	1	Pieces	4
Core Boxes	None		
Material in Pattern	Brass	In C. B.	
Wt. of 100 Castings	56#	Date	11/25/12
" " " "	53#	"	7/8/13
" " " "	55#	"	10/27/14
" " " "		"	

OVER

FIG. 6—PRODUCTION DEPARTMENT REPORT ON PATTERN SHIPPED FROM OR RETURNED TO PLANT

LOCATION OF PATTERN
7/1/0 - Factory
9/28/12 Globe Mal. Co.
6/20/13 Flagg
7/20/13 Factory
7/25/13 Flagg

FIG. 7—REVERSE SIDE OF CARD SHOWN IN FIG. 6

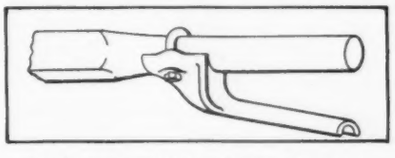
its proper shelf, or, if for a steel or malleable casting, the notation on the back of the pattern record card will show that the pattern has been turned over to the care of the purchasing department which keeps a record of all patterns sent from the factory and returned. However, if any of these patterns are delivered to any department in the factory, it is treated the same as any gray iron casting pattern.

When a pattern is shipped from or returned to the factory, the production department reports in writing, giving a full description of the material in the pattern and core boxes, number of pieces, states whether gated or not, and gives any other information that may be of value. These data are recorded on the 3 x 5 inch card shown in Fig. 6 and 7. At the bottom of the card will be noted a plan for keeping a ready reference of weights and a quick check against over-weights. These weights are recorded only after the castings have been received and weighed by our own men and checked with the invoice. It is not necessary to enter weights from all invoices, but the weights for castings should be recorded at least once a year, and the castings received from various foundries should be checked as far as the weight is concerned, so as to keep the castings to their proper weight. On the back of this card we locate the pattern. It would make no difference if the pattern should come back from an outside foundry, and only be in our possession ten minutes, a record would be made when it was returned and when it was re-shipped. For malleable castings we use a white card and a blue card for steel. We do this for two reasons; the first being to pick out the steel casting cards more quickly when needed, and the second being to check against ordering the wrong material in the castings.

Proper Protection for Barrows and Trucks

THE improper use of wheelbarrows or trucks is the cause of a great number of accidents. The committee on safety and sanitation of the National Founders' Association has issued a bulletin discussing the safeguards necessary to prevent these injuries. Some accidents arise because the wrong kind of barrow or truck is used for handling certain materials, or because the barrow or truck is of weak construction or in poor repair; some injuries are caused by the lack of handle guards for the protection of workmen's hands, or by unsuitable floors, pathways, or runways over which the barrows or trucks are wheeled. For the most part, however, injuries received by workmen when handling barrows and trucks are caused by their own carelessness.

Wheelbarrows should be selected carefully for the specific work that they must perform. There is a right barrow for every task, and usually the right one is the safest one. Barrows of comparatively light construction, built for handling coke, are unwieldy and excessively heavy when loaded with sand, cinders or coal; they will soon break down with such loads and may cause injury. Likewise coal barrows are too weak for moving castings; a small but strongly constructed barrow is necessary for this purpose. Barrows used for handling hot castings or cinders should be constructed of steel.



KNUCKLE GUARD FOR BARROWS AND TRUCKS

Consideration also should be given to the capacity of barrows. A barrow which is too heavy for a man to push easily when filled with materials may make him stumble or falter and upset the barrow with its load, and thus bring about harmful results. The excessive weight itself may cause an internal injury to the workman. On the other hand, if a barrow suitable for carrying a great deal of light material is used for carrying a small amount of heavy material, there will be waste of energy in pushing too much barrow and too little material. Such a barrow, because it is unwieldy, is not as safe as one of the right size and shape.

The proper balancing of the load will help to minimize injuries that may be caused by overstrain. Sometimes the method of loading material on the barrow will so balance the load that, when it is being wheeled, the greater part of the load will come upon the wheel and only a slight weight upon the man. But it is often impossible in this way to relieve the workman from *carrying* a weight which he should *push*, unless the barrow is carefully selected to hold in balance the material to be carried. Sometimes barrows with two side

wheels may offer the advantage desired.

When intended for use on sandy floors in foundries or on soft earth in yards, barrow wheels with wide treads will promote safety because the wheel will not sink into the ground readily, thus minimizing the strain of pushing the barrow, as well as the danger of upsetting the load. Barrows with narrow steel tread wheels are lighter and are moved with greater ease when wheeled over hard floors or pavements. The diameter of the wheel, or even the shape and length of the barrow handles, affects the safety and efficiency of barrows. Especial attention should be paid to the construction of barrows regularly employed to convey materials up or down inclines, because this work entails an added strain upon the man and an added chance for accident and injury. Similarly, when barrows are to be used for forward dumping of materials, they should be selected especially for this purpose.

In some plants it is the custom to hoist or lower barrows upon elevators. It then becomes advisable to limit the length of the barrow or its handles to allow ample clearance on the platform. It may also be wise to fasten suitable stops or sockets upon the elevator floor or to paint marks or lines to guide workmen in safely placing the barrows.

Frequently barrows must be wheeled through door openings or between piles of lumber, sheet steel, scrap, pig iron or castings which allow only a small space for passage. Workmen's knuckles and wrists are apt to be bruised or cut in striking doorways or other obstructions. In such cases the handles of the barrows should be equipped with knuckle guards which can be purchased from barrow manufacturers or can be made in one's own foundry or from sheet metal. Such a guard is shown in the accompanying illustration.

To prevent undue wear of axles and bearings and to provide for easy and therefore safer operation, they should be regularly greased. This is frequently neglected.

All barrows are subject to damage by exposure to the elements and by ordinary wear and tear. Wooden barrows can be preserved longer by painting them frequently, and iron ones can be guarded against rust in the same way. Where practicable, barrows should be stored inside of buildings, or at least under roofs. They should be stored in an orderly fashion, and not piled helter-skelter; their handles should not project into passageways and cause workmen to stumble over them. They should be inspected regularly. Barrows with worn axles, weak wheels, wabbly legs and unsafe handles should be taken out of service and assigned a space for temporary storage until they are repaired.

Storage of decrepit barrows in one place will facilitate quick repairs and induce the use of good parts of otherwise useless barrows, because such parts can be found most readily. It may also prove advantageous to keep a small stock of repair parts in the storage place. Where only one make of barrow is used, their interchangeability of parts will reduce the number and variety of parts which must be kept on hand. It is advisable to keep some extra barrows in stock to replace promptly such equipment as may become unsafe.

Danger is found in the use of narrow boards for barrow runways, either on inclines or across level openings, as from the ground to cars, or from cars to platforms or bins. Such runways should be at least 24 inches wide, substantially made, and with ends well secured, as a slight swerve in guiding the barrow or an unexpected movement of the plank itself may spill workman, barrow and load upon the floor or ground below. Such runways, whether portable or stationary, can be made safer by securing strips of wood or metal to their edges. These strips should project 2 inches or more above the surface. When used at an incline, where workmen are apt to slip, it is advisable to fasten cleats of wood or metal to the runway to provide a positive foothold. The cleats should not continue across the entire runway, but should leave about 10 inches of clear space for the wheel.

Practically the same precautions suggested in respect to wheelbarrows should be taken in the selection, use and care of trucks. Trucks, however, are more varied in their construction and use. They should be well-braced, of substantial construction, suited to their job, rightly used, and kept in good repair. Some trucks are built very high and are more apt to become top-heavy or unbalanced if not carefully loaded. Knuckle guards, similar to those used on wheelbarrow handles, may be used.

Most injuries received by workmen when handling barrows and trucks are caused by their own carelessness. These can be avoided only by the constant effort and influence of foremen and sub-foremen in driving home to their men the need of personal caution. This injunction applies especially to new men.

Flux to Prevent Gas Holes

By W. J. Keep

Question:—We manufacture special, hard iron castings, but these contain a large number of small holes, presumably caused by gas. We are desirous of securing a flux for eliminating this difficulty. With 850 pounds to a charge, our mixture contains steel castings, 200 pounds; car wheel iron, 400 pounds; hard iron castings, 100 pounds; and hard scrap, 130 pounds.

Answer:—Obtain a few pounds of commercially pure aluminum and use 1/10 of 1 per cent in the ladle. For a ladle containing 850 pounds of iron you would require from ½ to ¾ of a pound. Place the aluminum in the ladle before you catch the iron, no stirring being necessary. Powdered ferro-manganese also will effect the same result, but its action is not so positive as that of aluminum.

Book Review

Elements of Foundry Laboratory Practice, by Bernhard Osann; published by Julius Springer, Berlin, Germany; 34 pages.

This work is intended largely for school use and treats in an elementary way of the analyses involved in foundry work. Also, it is recommended for the beginner in the foundry laboratory, as it points out in simple, understandable language the various determinations for the elements in iron.

"Organization of Workshops and Factories" is the title of a booklet recently issued by Dr. Robert Grimshaw, New York University, New York City. The booklet embodies some of the material used by Dr. Grimshaw in a course of lectures on cost reduction given at New York University and also at the School of Science and Technology, Pratt Institute, Brooklyn, N. Y.

The General Electric Co., Schenectady, N. Y., in a recent bulletin illustrates and describes its line of hand-operated starting rheostats and panels for direct current motors. These devices range in capacity from ⅛ to 500 horsepower and are designed for use on 115, 230 and 550-volt, direct current circuits.

The Harris-Smith Coal & Coke Co., Uniontown, Pa., will remove its general office from Uniontown to the First National Bank building, Pittsburgh, Pa., on July 1. Shipping offices will be retained at Uniontown. O. E. Lafleur, formerly affiliated with the Berwind-White Coal Mining Co., will have charge of the coal department.

Intoxication, a Cause of Foundry Accidents

A Liberal Discussion of This Important Subject Treated From the Standpoint of the Prevention of Injury

By Thomas D West

SO MANY industrial accidents have been traced to the habit of drinking intoxicating liquors during working hours, that plant managers are gradually coming to consider the saloon an enemy of safety. As the result of this conviction a movement has been launched to further legislation which will prevent saloons being operated within 800 to 1,000 feet of any industrial establishment. Resolutions favoring such laws have been passed by the Cleveland, Philadelphia and New England foundrymen's associations. The American Foundrymen's Association, at its 1913 convention in Chicago, appointed a committee, of which the writer is chairman, to devise ways of pushing back the saloon. In the course of this work, I proceeded to take pictures of workmen stealing out to get drinks during working hours. After several days' trial I found that the number of sentinels generally on the lookout helping the smugglers was such that I would probably get more bricks than pictures, and hence I abandoned this method of working. However my experience in back yards and tie-tramping brought me in contact with tricks that are resorted to by employes to steal out to get drinks, which would be an eye-opener for many employers if they would attempt what I did in trying to get pictures. Among other surprising conditions I found men who as trusted yard foremen and watchmen served also as confederates to the smugglers. It all forcibly demonstrated to me that the only safeguard proprietors have against men sneaking grog into their plants is to have the saloons far enough away from their property lines, so that if workmen steal out there will be some chance for faithful supervisors to detect their absence from duty.

Abandoning the enterprise of a traveling photographer, I decided to take posed pictures which would illustrate a few of the many ways and means employed by workmen to carry intoxicants into the plant during working hours without any of the supervisory force being cognizant of such actions. There are firms that have ceased trying to prevent men stealing out to get drinks and that permit their passing out through the regular gate entrances at any hour. There are in this instance men to be seen going in and out, not only with one pail, but carrying two under the eyes of their firm's head officials. If one-half of all our firms would follow such practices we would soon be driven back to the day when all artisans or professional men were conceded to have no ability to do masterly work unless they were half drunk. This surely could not be tolerated universally now that all employers are held liable by the courts for all accidents, whereas a few years back employes were held responsible for what injury they might cause co-workers. We fail to perceive why a free gate is to be recommended for adoption by any firm.

The first of these posed pictures shows an employe who has left a saloon's side door and is about to cross the railroad tracks to reach the point where he is seen in Fig. 4, handing the drink to a confederate inside of the fence, which is about nine feet high. It makes little difference how high the fence is. The grog will get over it even though it might require a block and tackle to do the job. Another view shows a workman, with his bucket, stealing out of a hole made by a removable board in the fence. He

A paper read at the annual convention of the American Foundrymen's Association, Chicago, Sept. 8-11, 1914.

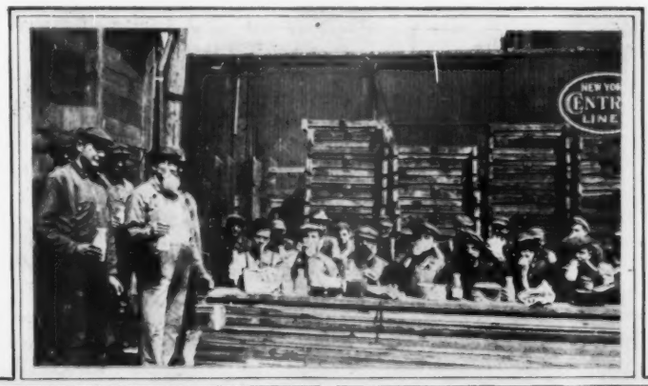


FIG. 1—MILK FOR LUNCH INSTEAD OF BEER

FIG. 2—WORKMAN RETURNING TO PLANT WITH A BUCKET OF BEER

FIG. 3—AN ACCIDENT RESULTING FROM INTOXICATION

might get to the fence by going through a basement or otherwise. Fig. 2 shows the miscreant, with his pail and perhaps a stomach full, returning to steal back into the shop. This special saloon building is about as close to the firm's property line as the fire limit laws will permit. A confederate is seen standing on the saloon steps. There is generally some one anxious to advise the smuggler whether the coast is clear for the sake of the drink he may get to recompense his services.

When the intoxicant is once inside the fence it must, as a rule, be hidden so that none of the faithful supervisory force can have any knowledge of its having been sneaked into the plant. It is often surprising the shrewdness and ingenuity that men thought to have little brains will display in devising ways and means to get intoxicants into a plant and hide them.

FIG. 4—PASSING THE BEER OVER THE FENCE INTO THE WORKS

FIG. 5—DRINKING FROM BUCKET HIDDEN IN FOUNDRY YARD

FIG. 6—MAN BEING DISCHARGED FOR INTOXICATION

Fig. 5 shows one of the ways. The barrel seen is in a corner of a foundry yard where the drinker is fairly sure of not being caught in emptying his pail as best suits his convenience. He can get to this in a few minutes so that his absence from duty is not noticed.

It is generally impossible for faithful superintendents and foremen to be sure that workmen are befogging their brains with smuggled drink until there is a quarrel or some accident occurs. When a supreme court in a state like Massachusetts hands down a recent decision such as the following, we are brought, as employers, face to face with an injustice for which it is difficult to find a parallel in any other situation in life,

"A drunken employe is a human parallel to the fragment of physical equipment which may be classified as defective material and cause injury to workmen. If one workman is injured through a drunken workman the employer's responsibility does not lessen, because of the intoxication. The employer whose defective equipment is the cause of the injury is responsible. The employer whose workmen cause injury to fellow workmen is also responsible."

Fig. 3 is a posed picture of an actual occurrence wherein an employe went out every lunch hour for a drink, brought back beer with him in his dinner bucket, and one day about half an hour after starting the afternoon's work was thrown 10 feet and knocked unconscious by the bursting of an emery wheel, which was thoroughly safeguarded. At the time of the accident this man was grinding small, wedge-shaped steel castings, and not having his wits about him he permitted the sharp end of one to be drawn in between the wheel and the rest, thus causing the wheel to fly into four pieces, one of which struck him in the head. He was carried to the hospital, where for many hours the doctors could not express an opinion whether he would live or not. In about six weeks he returned to his work.

Another accident, following only a short time after the foregoing in the same plant, was due to a man so befogging his brain with drink, unknown to the foreman, that he was unable to carefully steady one end of the bottom-pour ladle, illustrated in Fig. 9. It was a hot day and one of the men, instead of drinking good water or milk to quench his thirst, stole out between "blows of the steel" to get a drink at a nearby saloon. Upon returning and taking one of the handles he could not keep his end of the ladle steady so that the stream from the bottom could pass directly into the gate and fill the mold. Instead it hit the top of the flask and spattered the metal in all directions. This caused every one to run away from the ladle, but not before one man was very badly burned and several others so scorched as to necessitate the services of a doctor.

It is true, as some contend, that men can drink during the night or on their way to work in the morning so as to be unfit to be trusted in their positions, and on this ground some maintain that the only way for employers to guard against intoxicants causing accidents is for a community to be strictly dry. While this has much truth, still some have to acknowledge that if we cannot have a whole loaf, a half loaf is better than none. In this connection, men who are addicted to taking drinks during the night, or on their way to work, are generally known and "spotted" so that superintendents and foremen can be on their guard, whereas with the men who steal out during working hours, there is no method of warning the supervisors.

Fig. 8 shows men receiving cash for their wages, a practice generally followed by employers. However, there are firms that pay their employes by checks. This involves an evil that exceeds almost all others in attracting workmen to saloons. It causes many to commence imbibing intoxicants who otherwise might never indulge. There are no doors that open with a greater welcome and there are no places so glad to cash checks for employes as saloons. It is no unusual occurrence for the bill for drinks to absorb nearly, if not all, of a workman's check, thereby leaving his family penniless and his honest debts

unpaid. A firm that continues this practice when it has made no provision for cashing its employes' checks is not only disregardful of much that is involved in safety first but of morality as well.

Chas. L. Huston, vice president of a big steel and iron plant located at Coatesville, Pa., states that, "The decrease in accidents in our steel mills for the past six months with Coatesville dry is 54 per cent. The decrease in the application for aid during the same period is 75 per cent. While it was predicted we would experience difficulty in securing labor in a dry town we have had an abundance of labor at all times. Many have sought work in our mills because they wanted to work in a dry town where they could save some of their money."

Mr. Ridgway, of Craig Ridgway & Son, declared before the members of the Philadelphia Foundrymen's Association last spring that liquor is responsible for the majority of accidents in mills and factories. He further stated that "The liquor question has ceased to be a mere moral one and it is now a business question for business men to solve."

Wallace H. Rowe, president of the Pittsburgh Steel Co., in a letter to the liquor license judges of Westmoreland county, Pa., says, "This company employs 5,250 men in its mills, with a payroll of $300,000 per month. We have experienced a growing inefficiency in the service of these men and increased carelessness in the mills, resulting in accidents and death largely attributed to the heavy use of beer, whiskey and other alcoholic drinks. One of the largest steel companies in this district, after an exhaustive examination of the causes of accidents in the mills, makes the broad statement that 85 per cent of such accidents are due directly or indirectly to liquor."

A leading insurance company says: "A man whose nerves have been made unsteady by a recent debauch or the use of alcohol should not be permitted to operate dangerous machinery or to carry on dangerous work. He endangers not only his own life but that of others." There are few if any who would undertake to dispute this statement, but the great difficulty of the employer who has saloons close to his plant is to discover, before it is too late, when a workman should not be permitted to remain at his job. It is not at all uncommon to see men with befogged brains being discharged as shown in Fig. 6, but the difficulty, as previously stated, is to make this discovery before it is too late to prevent the injury that sneaking to nearby saloons to obtain drink during working hours can do.

The Zurich Building Trades Sick Club learned by statistics obtained during the years 1900-1906 that there were three accidents on Monday to two on other days. The German emperor states that, "Nerves are undermined and endangered from youth up by the use of alcohol, and that in war, the time for steady nerves and a cool head, victory lies with the nation that uses the smallest amount of intoxicants." The above is given regarding Germany to show that the claims made by many that imbibing intoxicants in that country does no injury are without foundation.

There is little question but that the existence of saloons close to industries has a greater influence in tempting the young and increasing the appetites of adults for intoxicants than almost any other agency that might be mentioned. Remove the saloon from the proximity of industrial establishments and it greatly helps to educate men away from the drink habit. This calls to mind recent utterances by William H. Barr, president of the National Founders' Association and general manager of the Lumen Bearing Co., Buffalo, at a banquet given in his honor by the Cleveland Foundrymen's Association last January. During the discussion of safety work at this banquet Mr. Barr stated that for a while he did not know whether he was operating a foundry or a brewery. He said that conditions became so serious that he concluded some efforts must be made to cause less drinking of intoxicants by his employes. He conceived the idea of trying to induce his men to drink milk in place of beer, especially during the noon hour. He installed a refrigerator in his plant and asked one of his trusted employes to commence this practice. For a while this workman was scoffed at by his fellows, but Mr. Barr said that an inspection of the refrigerator about a couple of months later disclosed the encouraging fact that 47 bottles of milk had been placed there for that number of workmen who had voluntarily adopted the milk-drinking habit. The facts regarding this innovation have been published before, but are repeated here for emphasis.

A realization of the great importance of Mr. Barr's innovation in helping men to discard drinking intoxicants caused me to labor for its extension. To this end I interviewed one of the largest milk dealers in Cleveland to solicit his interest in

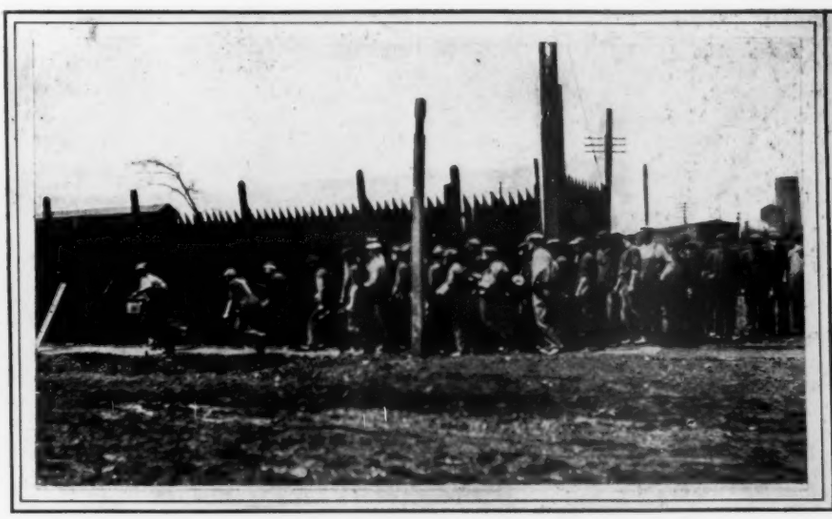


FIG. 7—THE NOONDAY RACE FOR THE SALOON

FIG. 8—MEN PAID IN CASH DO NOT VISIT THE SALOON

doing all he could to replace beer with milk in the city's industries. I was greatly pleased when informed he had done some missionary work in this line and was satisfied that if some educational or welfare society would take an interest in the problem, great progress could be made and accidents in our plants could be materially reduced. Believing this cause could be greatly aided in our city by appealing to proprietors, I sent out a large number of letters on the subject to employers.

Ralph H. West, president of the West Steel Casting Co., Cleveland, has recently installed a refrigerator to store milk for his men. Fig. 1 shows many of them taking their lunch out of doors in the shade instead of following the old practice of nearly exhausting their strength in a mad race for the saloon when the lunch hour whistle blows. The latter practice is shown in Fig. 7. Our firm supplies the ice to keep the milk cool. A pint bottle costs the men 4 cents. They purchase checks in quantities and hand them to a caretaker when they wish. The refrigerator is without a lock and the men are put on their honor not to take a bottle without depositing a check with the clerk, who is in another room. Some of the men not only have a bottle for their lunch hour, but also order one for the mid-morning or, more frequently, for the afternoon during the heat of casting time. In other words, they are free to obtain it when they please and to order as much of it as they desire. They find that it supplies a strength to the body that is invigorating and lasting.

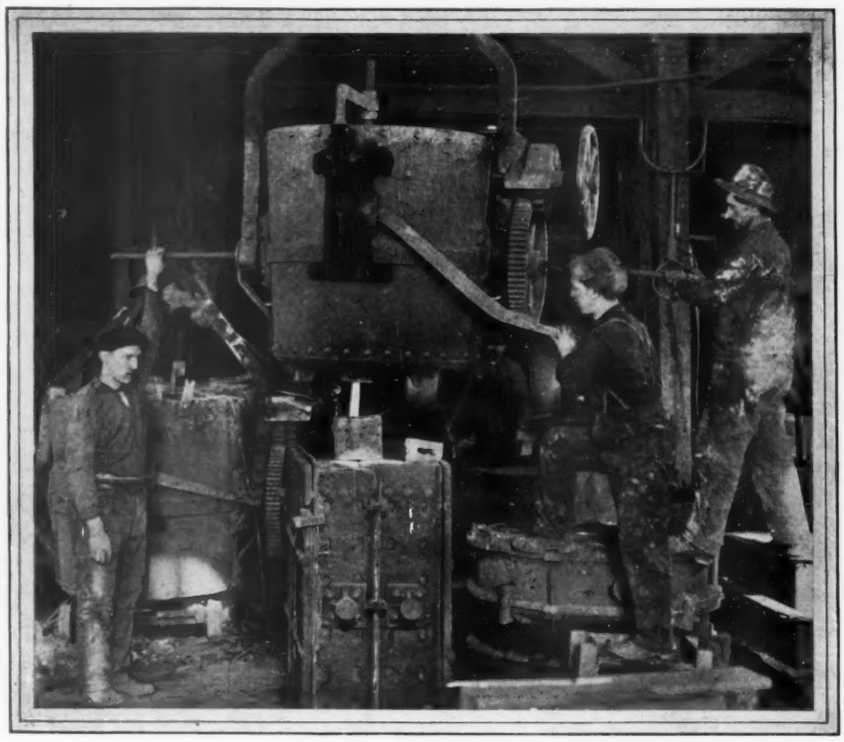


FIG. 9—ONE OF THE MEN AT THE LADLE CAUSED A SEVERE ACCIDENT BY DRINKING DURING WORKING HOURS

"Back With the Saloon" agitation as a safety first measure has done much during the past year to influence the strict disciplining of men addicted to drinking. Almost everyone recalls our navy's late restriction on the liquor question. However, of the many prohibitive steps employers are now taking to cut out the drink, we give only the following to show the tendency of the time. A recent editorial in the *Chicago Inter-Ocean* says:

"This is the duty of the sober man. Time was, and not very long ago, when the brilliant alcoholic could hold a job in almost any trade or profession. That time is past. Industry has come to realize that dependability is better than brilliancy and that brilliancy itself is more common with men of clear heads than with those whose brains are muddled with alcohol." *The Atlanta Constitution* says: "You young men or middle-aged men or old men had best take note of the sign of the times and make up your mind to the fact that in this day and generation it is your drink or your job. You may compromise with your conscience or laugh at the temperance orator, but you cannot fool the man with your job in his hands. Nor can you sign a truce with the growing ostracism that separates success from the man who habitually crooks an elbow."

There is little doubt but that several states soon will witness an agitation of questions involved in the use of intoxicants, especially in the cities, such as they have never seen before. It behooves all desirous of advancing safety first work to help shape events so that in any of the entanglements of politics to come, the saloon shall at least be forced back 500 to 800 feet from the property lines of foundries, mills, factories and other industrial plants, in order to assist the work of reducing accidents.

Scrap for Cupola Malleable

Considerable interest is manifested among manufacturers of malleable castings, who melt their iron in cupolas, regarding the use of light steel scrap. White pig iron and the sprues of the previous cast usually are used in the mixture and the addition of steel will have a tendency to lower the carbon content. However, care should be exercised to ascertain the silicon content of the pig iron, as the steel also will lower the silicon in the mixture. It can be safely suggested that 20 per cent steel can be used without difficulty if the pig iron is sufficiently high in silicon to insure the total content of this element in a mixture of no less than 0.65 per cent. The best steel scrap that can be used consists of rail ends of a suitable size, but if light, thin scrap is employed considerable trouble will be experienced. If the silicon drops below the figures given, considerable trouble will result in annealing and the iron will be steely.

When such small pieces as punchings or small clippings are charged in the cupola, they frequently drop through the melting zone, and being badly oxidized in front of the tuyeres, they do considerable damage to the molten iron. Steel stampings or punchings should not be used by the manufacturer of cupola malleable on account of the large losses involved.

The Tropenas Converter Co., 50 Church street, New York, is erecting an office and laboratory building in Brooklyn, N. Y. The chemical and metallographical equipment already has been purchased and the contracts for the equipment for the physical testing plant will shortly be placed. The site provides sufficient space for the erection of a small experimental plant in which a novel steel producing method will be developed.

The Important Problem of Obtaining New Work

Suggestions for the Foundryman, Enabling Him to Secure Orders at a Price That Will Net a Profit

By H J McMurtrie

WHILE we hear discussions in the conventions of foundrymen and foundry foremen concerning cost systems, improved machinery and advanced methods of producing castings, and read article after article on the same subjects in the trade journals, yet it seems to me that a certain phase of foundry practice, which has a direct bearing on the net profits on the tonnage of a plant, is not receiving the consideration it deserves.

I refer to the taking of new work. This may seem like sounding a note against progress, but if we will carefully consider the matter in the light of what is real advancement, it will be seen that there is a difference between true and false progress.

A live foundryman is ever on the lookout for ways and means to increase his output, but he must not let his eagerness to accomplish this run away with his judgment. The two ways open to him to enlarge his business are to find a broader market for the class of work he is making and to take on entirely new lines of work.

The first is obviously the safer course to follow, as his equipment and training are at hand for easy development, but unfortunately often this is not feasible. The second course open to him is attended by difficulties, which if not overcome in practical ways, will work not only an injustice to himself but will bring a useless hardship upon his competitors, thereby putting the whole foundry industry, to a greater or less degree, at a disadvantage.

Manifold Difficulties

These difficulties are manifold. The foundryman must consider his equipment, his irons, his sand, the training of his molders, the comparison of his regular work with the intended work as to quality and finish, together with the requirements of both in the finished article, and last, and to me the most important of all, the determination of a fair and profitable selling price for the new class of castings. The injustice he may do himself in over-estimating his ability to turn out the work is wholly his affair, but when he takes from another, work which is proving profitable, at a price which, either through ignorance or willfulness, is below cost of production, he is fostering a condition which is demoralizing to the industry.

It is to this condition and to its remedies that I wish to direct the earnest attention of every foundryman.

If a plant is producing high grade castings the quantity of iron which goes to the pig bed may seem excessive and the desire to utilize this apparent waste may tempt the foundryman to take on some low grade work at low prices, in the belief that he is increasing the tonnage of his output without having to take into consideration the cost of melting and other incidental expenses which he must figure against his regular work. There may be some foundation for his reasoning, but in the long run it is most likely to prove a fallacy.

Must Consider Cost Factors

There are many reasons for this. His molders are not trained to turn out the big tonnage such a class of work requires to be profitable. There is a standard price for the work, and in meeting it his labor bill exceeds his receipts, for a molder used to putting up 150 or 200 pounds of castings will not readily double or triple that quantity, owing to the fact that he has not the necessary equipment. Then too, the greatly increased amount of metal to be poured off does not appeal to him. His irons are not mixed properly for heavy, coarse work and will not readily make the solid castings required. His sand is too fine to let off the gases, causing blow-holes and shrinkages. His equipment is not suited to the work and much time is lost in putting up the molds. In this case the injustice is principally to the foundryman himself, for he must soon see the folly of his way and the work will shortly return to the hands where it belongs and probably without having affected that standard price, for he has already been so foolish as to underfigure the prevailing low price. While the experience may have been costly, yet it is money well spent if the results remain permanent.

But far more serious to the general welfare of the industry is the practice of some foundrymen, of undercutting competitors on a class of work but slightly inferior to that of their regular output, believing they can make a profit by using the tail-end of their heat. Just stop and think what would be the result if some one should do the same on every class of castings. The profits of all foundries would vanish. Every job should carry its share of expenses in figuring the price. Every foundryman who allows himself to be misled into such a method of obtaining work lends himself, to just such an extent as he persists in following this course, to the bringing about of a condition of the utmost danger to himself and his competitors. If it does not foster a spirit of retaliation among his competitors, resulting in the loss of some of his profitable work, it will, sooner or later as he fails to find the expected increased profits in his balance sheets and his experience has not been unfortunate enough to cause him to change his viewpoint, lead him to take on more and more work on the same basis in the endeavor to bring about satisfactory results and so increase the end of his heat until it represents the major part of his melt and he finds a deficit squarely facing him.

Fails to Discriminate

Again, the foundryman producing low grade castings may not realize the many features entering into high grade work which tend to a much higher level of cost, and he sees no reason why he may not garner much tonnage at far below the prevailing prices. In getting into that market on such a basis he does himself no good, but disrupts fairly satisfactory conditions among others. The odds are that he will not hold the work, as the castings will not meet the requirements; but he will create in the mind of the user of those castings a belief that he has been paying too much for his work. That belief, once installed, may remain fixed for a long time, causing the user to conclude that while he may not get his work at the ridiculously low prices quoted, he should not have to pay what now seems to him the excessively high prices of his former foundryman, while in reality those prices were only just for the quality of castings demanded. An unsatisfactory condition therefore

is created for all parties concerned without accomplishing good for anyone.

Then there is also the fellow who goes around naming prices which he knows are under cost, with the purpose of securing patterns and as quickly as possible advancing his prices to that which he knew all the time the work was worth, in the hope that once getting the patterns in his possession he can hold them. This he may do if he can furnish castings superior to those the buyer has been getting, but otherwise he will probably lose out, as such a method does not appeal to many. I doubt if anything can be said in favor of this practice and the sooner it is discarded, the better.

If you find a class of work you think you would like to try out, meet the situation in a business-like way. Your experience as a foundryman will enable you to see many of the difficulties you may have to overcome. Give the matter earnest and careful consideration. If, after considering it from all possible angles, including equipment, mixtures of iron, molders, sand, etc., you are satisfied that it is a field worthy of your efforts and within your limitations, do not hesitate to make the necessary expenditures that you may be on an equal footing with those with whom you will have to compete. If the work is of such a nature that your past experience will not give you sufficient basis for definitely determining the cost, use your ingenuity to secure a few patterns and thoroughly test them out before taking any steps that may produce dissatisfaction among others and at the same time present little likelihood of profit to yourself.

Remember that straightforward methods will make satisfied customers and will build up your business.

Loss in Melting

By W. J. Keep

Question:—We are about to conduct a series of experiments to determine, if possible, our exact losses in melting. What percentage of iron oxide, from two samples of slag taken at the beginning of the run and at the end, will be considered good melting practice? What is a low percentage of general loss on the entire melt, provided we endeavor to reclaim all sprues and shot, bad castings, and all the iron from the bottom with a water mill?

Answer:—The percentage of oxide in slag depends upon the oxide in the iron charged and the action of the blast. A fair average during any part of the heat would be 6 per cent, although 10 per cent would not be excessive. Regarding the general losses, unless you can do all of the weighing yourself and take precautions which are not practical, such an investigation would not be fruitful of results. In practice we already show any loss and sometimes show a large gain. When we start careful men to investigate we invariably find that the gain comes from mistakes of some kind, but from a scientific point of view the facts might be interesting.

A good many years ago I made the following tests. I began by melting one ton of iron in a cupola 50 inches in diameter inside of the lining, which was equipped with two rows of tuyeres. The iron would not melt and I found that the blast from the upper row of tuyeres was directed onto the iron. The upper tuyeres were closed with clay and have never since been opened. The next trial was a failure, as the iron was too thick to run. The fire was not started as early as would have been the case for a heat of 20 tons and this explained failures in many previous experiments. The next time I heated the cupola to a melting temperature and had good iron. Before starting each test I had a clean cupola. Everything around the cupola was swept clean and the material for each experiment was carefully weighed. I did not weigh the coke, as all I sought was a clean and quick melt. I had no small cupola at that time or I would have used one 22 inches inside diameter. After each heat every particle of iron in the drop was picked out by hand, a ¼-inch mesh sieve having also been used. A water mill, while exceedingly satisfactory in results, also will deliver considerable slag rolled to resemble shot iron and will make your loss appear less than it should be. This, however, does no harm in every-day work.

The following experiments were made one winter when we were taking off two regular heats during the week in one cupola and one of these heats was a test heat. Before making these tests the sand heaps were screened, the gangway swept and the scaffold was perfectly clean. Before the tests were made one car of coke and one car of each kind of iron used in the mixture were set aside and the scrap to be used for this purpose also was selected and laid out and the average analysis from each was obtained. After the 37-ton heat everything was swept and each item weighed by reliable men. The results of the various tests are given in the accompanying table.

Melting Loss Experiments

Loss in melting one-ton heats.	Loss, pounds per ton.	Percentage of loss.
No. 1 Cherry Valley pig, silicon, 2.72 per cent; sulphul 0.01	95	4.75
Cleaned new stove plate	1.59	7.95
Cleaned, new sprues	1.30	6.50
Old stove plate scrap (purchased)	2.27	11.35
New stove plate with sand on	2.30	11.50
New stove plate sprues with sand on	2.80	14.00

Regular 37-ton stove plate heat.	Loss, pounds per ton.	Percentage of loss.
Loss from whole heat, calculated	116	5.80
Loss from whole heat, actual	88	4.41
	Pounds per ton.	Melting ratio.
Shot and screenings recovered from gangway	26	
Sand recovered from gangway	111	
Coke recovered from dump	57	9 to 1
Limestone used as flux	43	
Slag tapped out	207	

Regular 37-ton heat	Actual strength, pounds.	Actual shrinkage.
Test bars, ½ inch square by 12 inches long	380	0.149
No. 1 Cherry Valley pig, one ton heat	410	0.149
Cleaned new stove plate, one ton heat	390	0.162
Cleaned stove plate sprues, one ton heat	375	0.158
Old stove plate scrap, one ton heat	377	0.202

Shrink Holes in Castings

By W. J. Keep

Question:—We are engaged in the manufacture of machine tool castings, but are experiencing some trouble from excessive shrinkage and dirt and slag inclusions. For lathe beds our mixture consists of 500 pounds of pig iron and 500 pounds of machinery scrap.

Answer:—If it is possible to place a riser over the spot that causes the trouble and to feed the casting at this point, you may be able to overcome your difficulty. The use of a chill would prevent shrinkage near the surface. If you collect the heavy cast iron chips from drills, planers and millers and pack them in boxes holding 50 pounds and charge one of these boxes in place of 100 pounds of scrap, it is probable that the trouble will disappear.

How Titanium-Aluminum Bronze is Produced

Facilities of the Titanium Alloy Mfg. Co., Niagara Falls, N. Y., For Making and Testing This Valuable Alloy

By C Vickers

IN THE affairs of mankind, metals always have played an important role; without them it is difficult to conceive of the present state of society. They enter into the smallest details of our life, for such insignificant objects apparently as pins and needles, mere slivers of metal, would be extremely difficult to get along without. The first metals to be pressed into service by man were naturally those most easily procurable, such as copper which is found native, and because of its ductility could be pounded into shape with such rude implements as stone hammers. The next step in the evolution of metal recovery was when some primitive genius discovered the utility of fire in connection with the shaping operations, and after this step had been taken it was soon discovered that the metal would melt, and that much labor could be saved by casting it roughly to shape in clay molds, and then finishing the objects with the hammer.

However, it will not be necessary to trace the development in the working of metals; there is no doubt that progress was as slow as it usually is, and generations may have passed before some artificer enclosed his smelting fire with certain peculiar stones and discovered that something had changed his copper from a soft, ductile substance with a red color, to a hard, gold-colored alloy much better suited to his needs, thus opening up a new line of research which ended by the discovery of how to smelt tin. The metals that first came into service were those most easily reducible from their ores, and with the growth of metallurgical and chemical knowledge the number of metallic elements that became available constantly increased until the last important construction metal, aluminum, was commercially produced. Previous to this, however, one of the most important discoveries in chemistry had been made; namely, that of metallic sodium by Davy in 1807. Aluminum was not obtained in the metallic form until 1822, and then only as a powder, and not until 1842 as a compact metal.

Previous to the discovery of sodium (and potassium, which has similar properties) carbon was the only agent available for reducing metals from their ores, and those metals which refused to part with their oxygen to this element in ordinary smelting operations, remained unknown. The addition of sodium and aluminum to the list of available metals gave metallurgists two powerful reducing agents, and another great aid was the electric furnace. As a result of these discoveries there are few, if any, known

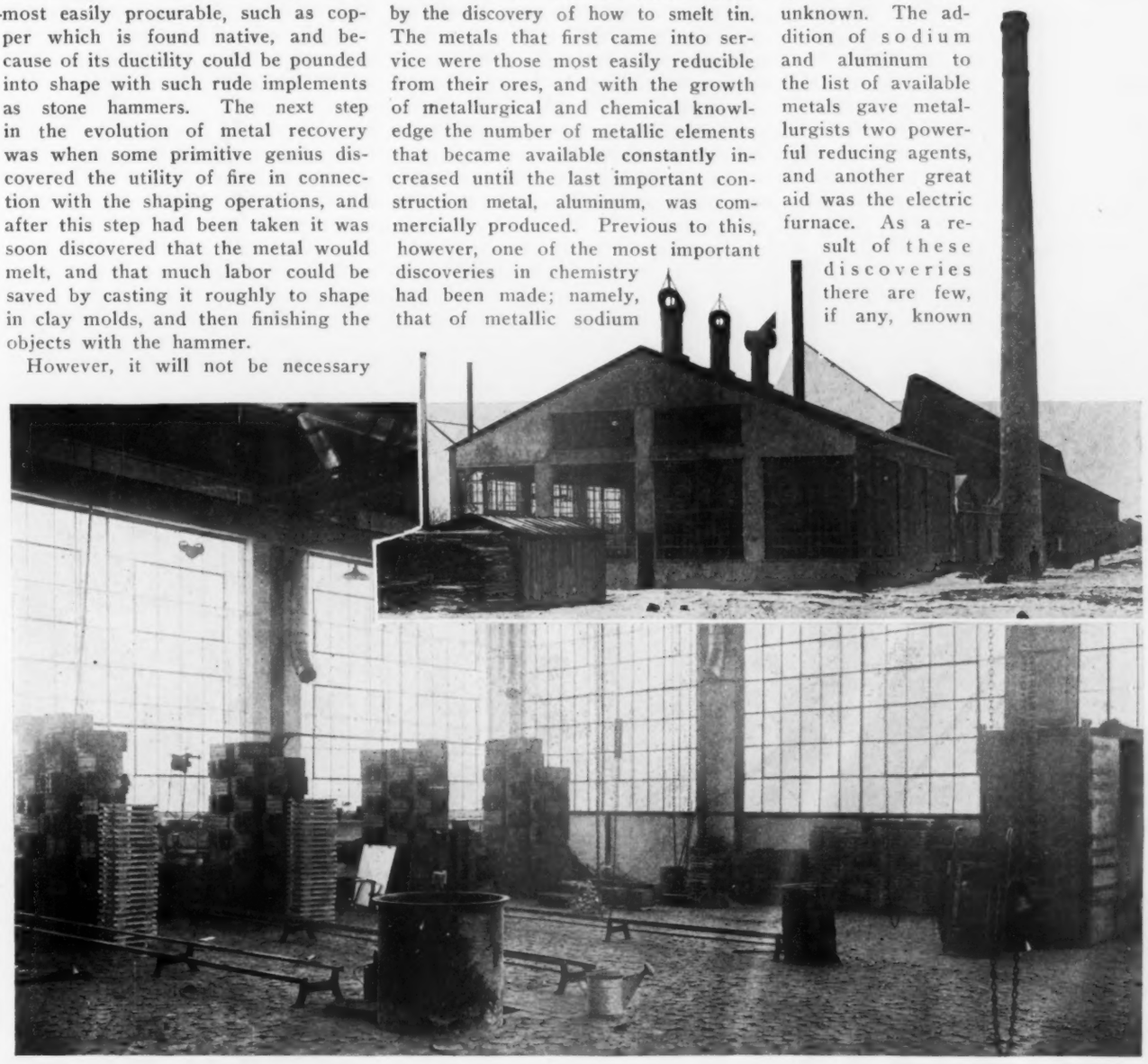
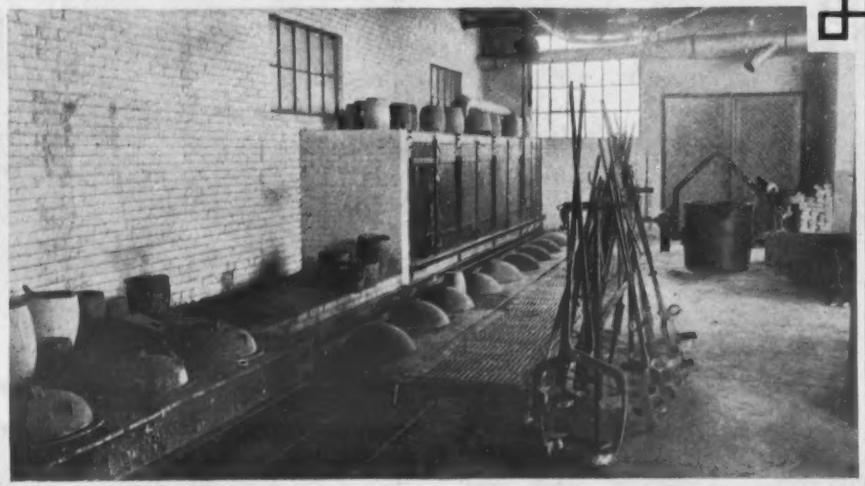


FIG. 1—A SECTION OF THE MELTING FLOOR OF THE TITANIUM ALLOY MFG. CO.'S NEW BRONZE FOUNDRY AT NIAGARA FALLS, N. Y.

FIG. 2—NEW FOUNDRY BUILDING, HEATING PLANT, WITH SAND AND COKE STORAGE IN THE DISTANCE



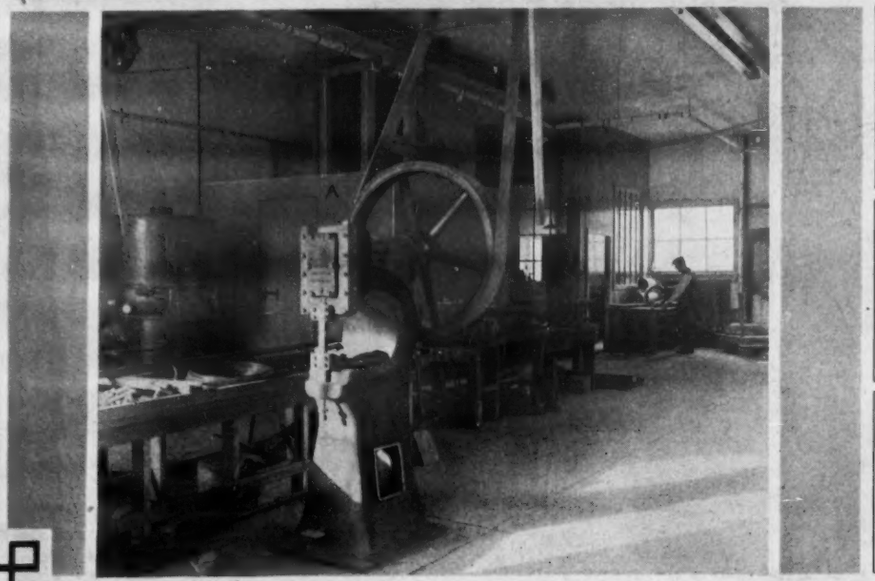


FIG. 3—ANOTHER SECTION OF THE FOUNDRY, SHOWING THE CORE BENCHES AND MOLD DRYING OVEN
FIG. 5—A SECTION OF THE CASTING CLEANING DEPARTMENT

FIG. 4—FURNACE ROOM, SHOWING THE BATTERY OF NATURAL DRAFT FURNACES AND THE ELECTRICALLY-HEATED CRUCIBLE OVEN
FIG. 6—THE METAL STORAGE ROOM WHERE THE MIXTURES ARE MADE AND WEIGHED FOR THE FURNACEMEN

metallic elements that cannot be reduced to the metallic form.

One of the most obstinate elements to reduce was titanium, and even now with the aid of aluminum and the electric furnace it cannot be prepared as a metal, but is only obtained at great cost by the reduction of its chloride by sodium. As a metal it resembles iron in appearance, though chemically it is usually classed with the silicon, zirconium, cerium and thorium group, and differs from the other members of this family in that it will not combine with hydrogen.

Metallic titanium, like silicon and many other of the elements, when in a finely divided condition, burns in the air to the dioxide, but when in massive form may be heated bright red without decomposition, as a thin deposit of the dioxide forms on the surface and protects it from further oxidation. Massive metallic titanium is sufficiently hard to scratch glass, and has the peculiar property of leaving behind it a delicate, silvery mark which is so permanent that it cannot be obliterated by ordinary usage.

When titanium is reduced from its ores by carbon to form ferro-titanium, used so extensively and successfully for removing oxygen and nitrogen from iron and steel, there results a triple alloy of iron, carbon and titanium, which can be produced commercially and at a moderate price. Furthermore, it is equally as effective as metallic titanium in cleansing the metal bath to which it is applied. This is fortunate, as otherwise the use of titanium would involve too great an expense for practical use in the iron and steel industry.

The Triple Alloy

In the case of non-ferrous alloys, however, carbides cannot be used because they do not decompose at the temperature of a copper or bronze bath, and also because copper and carbon do not combine; therefore, no reaction is possible. Consequently, it is necessary for the titanium to be in metallic form for use in non-ferrous metallurgy. There are two ways of preparing it for this purpose; one as previously described, in which metallic titanium is directly dissolved in molten copper, to form titanium-copper, or more correctly speaking, titanium bronze, and the other, by the direct reduction in the electric furnace, of titanium dioxide, TiO_2, by aluminum in a bath of copper. By the latter method there is produced a triple alloy of copper, aluminum and titanium, the principal use of which is as a deoxidizer of other metals.

The composition of the alloy, as it comes from the furnaces, varies somewhat with each heat, and therefore it is remelted, according to the analysis of each heat, in such proportions as will bring the product to one uniform grade. In this connection, it may be stated that an alloy of 12 per cent titanium, 12 per cent aluminum, and 76 per cent copper is probably the hardest and strongest bronze that can be made, but as it cannot be cast in molds, it has found no useful application.

In experimenting with titanium in copper, it was found that it had no effect upon the electrical conductivity and general appearance of the castings, regardless of whether the pure alloy, made with metallic titanium, or the aluminum-reduced alloy was used. This probably was due to the small amount added, and as the aluminum alloy could be more easily and cheaply produced, the manufacture of the other alloy was discontinued. All the titanium-copper now used is made in the electric furnace to form an alloy of titanium, aluminum and copper. Since it was evident that the small aluminum content could not possibly harm an alloy containing aluminum, it was natural that aluminum bronze should be chosen as the most suitable alloy in which to test the properties of titanium, and as a result of a large amount of experimental work, a process of treating aluminum bronze was developed which insures freedom from dross and blowholes and makes the founding of this excellent metal commercially practical. The alloy so treated was called titanium-aluminum bronze, and in order to introduce it commercially, the Titanium Alloy Mfg. Co., Niagara Falls, N. Y., built and equipped the modern bronze foundry shown in the accompanying illustrations.

Allied with this bronze casting plant is a well equipped chemical

FIG. 7—GENERAL VIEW OF THE PHYSICAL TESTING LABORATORY, WITH THE DARK ROOM IN THE DISTANCE

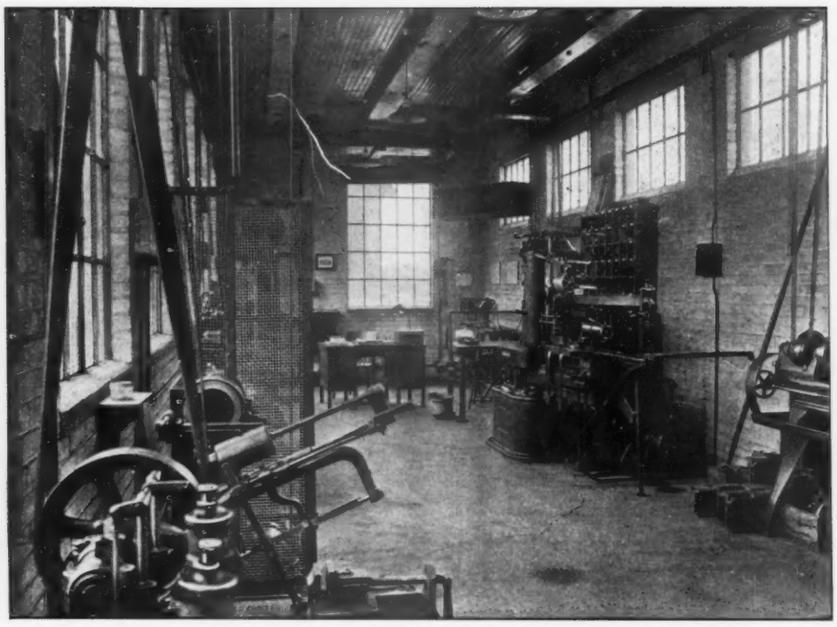


FIG. 8—ANOTHER VIEW OF THE PHYSICAL TESTING LABORATORY

and physical laboratory which antedates the brass foundry by several years and was installed primarily to carry on the research work in connection with the introduction of titanium in iron and steel, and later with non-ferrous metals and alloys. The section of the chemical laboratory devoted to the analysis of copper alloys is shown in Fig. 10. Through the doorway is seen the private experimental room where chemists are always busy discovering new uses for titanium. Fig. 11 shows the opposite end of the laboratory, with a partial view of the balance room. In Fig. 9 is illustrated the section of the laboratory devoted to the analysis and investigation of iron, steel and the various ferrous alloys.

Physical Testing Laboratory

The physical testing laboratory is located in a separate building of brick and steel construction, which is well-lighted and electrically-heated. A general view of this department is shown in Fig. 7. At the left, behind the desk, is the polishing stand, which is equipped with electrically-driven polishing and grinding discs for the preparation of metallographic specimens. In front of the stand is a 100,000-pound Olsen tensile testing machine and beyond this is a small lathe for turning specimens. In the corner, at the left, is a Fremont impact machine which drops a 10-kilogram weight upon the test piece from any desired height up to 4 meters, and the force remaining in the weight after breaking the test piece is measured, thus giving the force absorbed by the resistance of the piece to the impact of the blow. The test pieces are 30 millimeters long, 10 x 8 millimeters in cross-section, and are nicked 1 millimeter deep in the center of the under side. At the right, in the foreground, Fig. 7, is the Brinell hardness testing machine. It operates by pressing a hardened steel ball, 10 millimeters in diameter, into the specimen to be tested. The pressure is generated hydraulically by a small oil pump, and is accurately controlled by weights acting on a release valve, so that it is impossible to make the pressure too high. The depression produced by the ball is measured by a scale adjusted to a microscope, and the hardness number is found from this measurement by the aid of a table. The diameter, not the depth, of the depression is measured.

Endurance Testing Machines

At the right also are shown the White-Souther and the Landgraf-Turner endurance testing machines. The White-Souther machine utilizes a specially-shaped test piece, which is held rigidly in the axis of a wheel and is revolved at a speed of 1,300 revolutions per minute. The ends of the piece projecting on each side of the wheel are loaded with weights which hang downward constantly. Each complete revolution of the wheel thus involves two reversals of stress in the specimen. A counter on the machines records automatically the number of hundred revolutions endured before fracture, and this number gives an estimate of the resistance to fatigue of the metal tested. Since the stresses used in this test are well below the elastic limit of the metal tested, it is the nearest approach of any test to the conditions of actual service. The maximum fibre stress in the specimen is controlled by the number of weights used on the machine, and for a quick test, these weights are adjusted to bring the stress nearly up to the elastic limit of the test bar as found from a previous tensile test. For a more normal, but longer test, fewer weights are used. However, when two different test bars are to be compared, the weights used are kept exactly the same for both.

The Landgraf-Turner testing machine

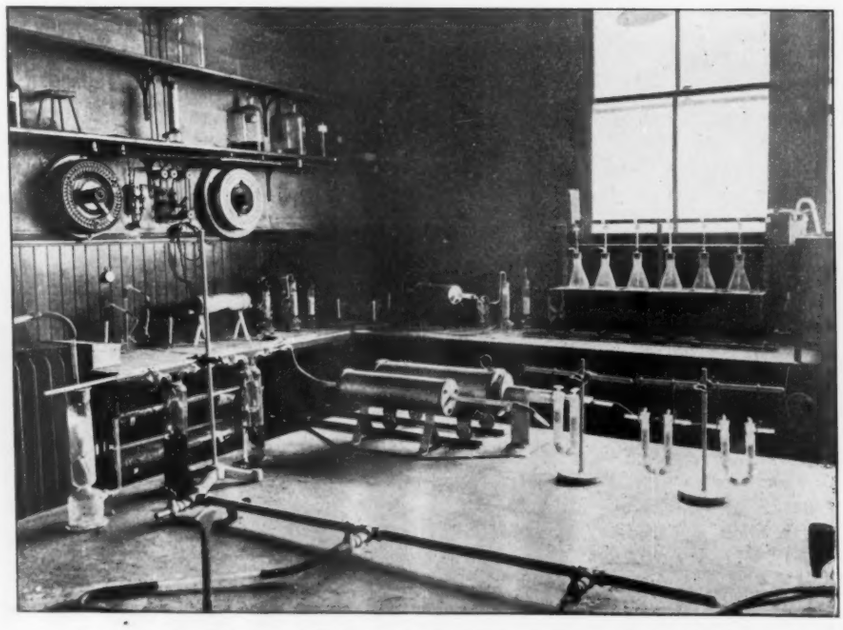


FIG. 9—SECTION OF THE LABORATORY WHERE THE ANALYSES OF FERROUS ALLOYS ARE MADE

makes an alternating impact test; one end of a bar, 8 inches long and ⅜-inch round, is held rigid, while the other end is bent backward and forward through a small angle by blows repeated 400 times per minute. The number of alternations endured before fracture is recorded automatically. Since fracture takes place close to the end of the specimen, each end may be tested, and the one test checks the other.

Another view of the physical testing laboratory is illustrated in Fig. 8, which is taken from the end opposite Fig. 7. The box-like object suspended from the ceiling is the cover for the Leitz microscopic outfit which is used in observing and photographing the micro-structure of the various metals and alloys.

The Foundry

The new foundry buildings are located at a considerable distance from the offices and the chemical and physical testing laboratories. The foundry, Fig. 2, is 60 feet wide x 45 feet long and is used entirely as a molding shop. It is of brick and steel construction, the end being plaster on metal lath to facilitate extensions by easy removal. The stack is 100 feet high, of tile concrete construction. It furnishes the draft for a battery of 12 natural draft coke-fired furnaces, of diameters ranging from 19 to 22 inches, taking No. 100 and No. 150 pots. The flue connecting the furnaces and the stack is 36 x 24 inches, and at the end nearest the stack is a crucible oven, which is heated electrically to a constant temperature above 212 degrees Fahr.

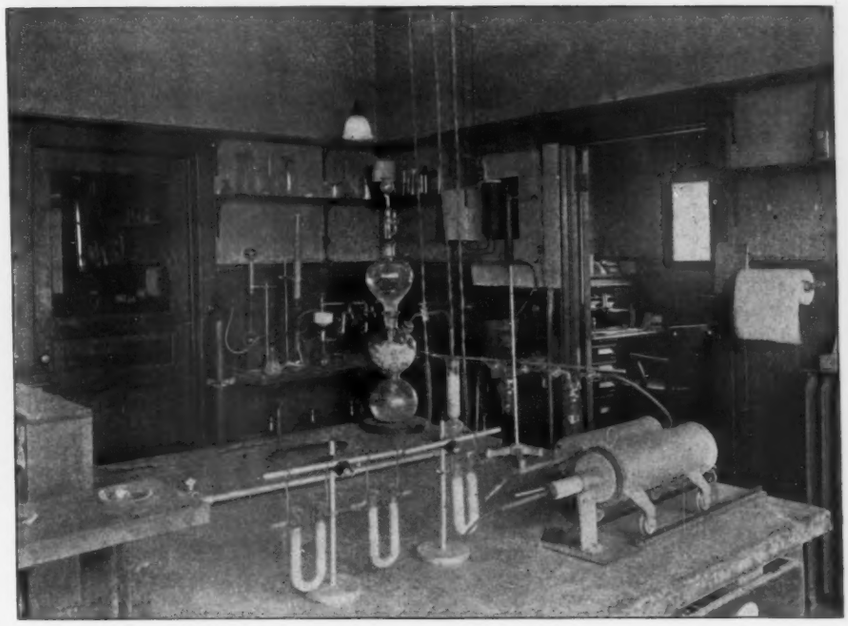


FIG. 11—ANOTHER VIEW OF THE CHEMICAL LABORATORY

The coke-fired furnaces are installed in the old experimental building, the roof of which projects above that of the new building, in Fig. 2. An interior view of this building is shown in Fig 4. The raised battery of three furnaces in the foreground comprises the melting equipment of the old experimental shop.

Interior Arrangements

An interior view of the new foundry is shown in Fig. 1. It will be noted that the sides of the building consist almost entirely of windows, thereby insuring an abundance of natural light. For artificial illumination, a number of 100 candlepower tungsten lamps have been installed. The foundry is equipped with two 2,000-pound, hand-operated traveling cranes, and one 10,000-pound crane of the same type. For heating the building a fan-driven hot air system is employed, and in summer the hot air pipes distribute cold air throughout the shop. At the right, Fig. 1, is an electrically-heated core oven used for baking small cores. Another view of the molding room showing the cores is illustrated in Fig. 3. The mold drying oven of the car-type, which also is used for baking large cores, designed by Henry M. Lane, foundry engineer, Detroit, also is shown in Fig. 3. It will be noted that the foundry floor consists of cedar blocks set on cement. This has proved exceedingly durable.

FIG. 10—SECTION OF THE CHEMICAL LABORATORY WHERE THE ANALYSES OF NON-FERROUS METALS ARE MADE

Metal Storage

A view of the metal storage is shown in Fig. 6. In this room the metal supply is stocked and an attendant is in charge constantly, whose duty it is to weigh out the various mixtures for the heats as required by the furnacemen. In the short time that the foundry has been in operation titanium-aluminum bronze castings have been made weighing up to 1,600 pounds each. Many other high grade alloys also are made; in fact the Titanium Alloy Mfg. Co., specializes in unusual alloys. Copper castings also are made which have a guaranteed electrical conductivity of 70 per cent in the castings, the actual conductivity, however, being much higher.

Some of the alloys are noted for great hardness; in one case 445 Brinell

was attained, using the 3,000-kilogram weight, while another alloy has a tensile strength considerably in excess of 100,000 pounds per square inch. One excellent feature of the shop is the separation of the furnace room from the molding floor, and although connected by a number of open doorways, the smoke and heat incident to the melting operations fail to penetrate into the department where the molders are at work. This and other special features result in a high production per man per day.

Adjoining the furnace room, but on the side opposite the molding floor, is the experimental department. It is equipped complete for the production of castings, the metal being melted in both electric and coke-fired furnaces. Here the chemical engineer or metallurgist can test theory by practice and frequently can discover facts about the deoxidizing of metals that will save far more than the experimental work will cost.

In the rear of the experimental department are the toilets, wash rooms and lockers. These rooms are well-lighted, sanitary and comfortable, the locker room being furnished with tables and benches for the use of the men while eating lunch. Also it is provided with a case from which cigars, cigarettes and tobaccos are sold at cost. The experimental department and adjoining rooms are located on one side of a wide passage connecting the furnace room and foundry with the cleaning and shipping departments; on the opposite side of this passage way is a blank wall, beyond which the metal storage is located.

Fig. 5 shows one section of the cleaning department, the sand blast room being indicated at *A*. Back of the cleaning room and separated from it by a solid partition is the sand, coke, coal and charcoal storage, also the heating plant, which is enclosed separately, although housed in the same building as the sand and coke. This structure is about 250 feet long x 65 feet wide, and contains only one titanium electric furnace. This building is paralleled by another of the same size which is divided longitudinally into a transformer and furnace room; in the latter are installed the large ferro-titanium electric furnaces which are operated continuously. Numerous other buildings, housing massive and expensive machinery in addition to the ones described, comprise the plant of the Titanium Alloy Mfg. Co., which covers a site of several acres at Niagara Falls, N. Y.

PROBLEMS OF THE BRASS FOUNDER

What To Do and How To Do It

Melting Brass in the Cupola

We have received an order for a large bronze statue and we have decided to melt the metal in a cupola. The furnace is lined to 40 *inches and the mold will require about* 1,300 *pounds. What should be the depth of the coke bed and the blast pressure necessary to bring down hot metal? The mixture will consist of copper,* 88 *per cent; zinc,* 7 *per cent; tin,* 4 *per cent and lead,* 1 *per cent. We will use* 600 *pounds of new metal and* 700 *pounds of remelts and gates.*

We suggest that you adhere closely to the regular practice pursued in melting iron. The melting ratio for iron varies considerably. Sometimes it is below the ratio for bronze and occasionally it is higher. In one instance, melting brass in the cupola, the following schedule was adhered to: Fire lighted at 11:00 a. m., first brass charged at 11:40, blast on at 12:00, first brass at 12:03; first tap at 12:13 and bottom dropped at 3:04 p. m. The bed consisted of 100 pounds of coke and the first charge of brass was 600 pounds. This was followed by 65 pounds of coke, 500 pounds of brass, 60 pounds of coke, 500 pounds of brass; and this ratio was continued until about 2,000 pounds of brass was melted for the casting. For a casting weighing only 1,300 pounds, crucible melting would give the best results. If a cupola has to be employed, it would be advisable to melt the zinc, tin and lead separately and to pour them into the ladle after the heat has been tapped therein. Before tapping the metal into the ladle prepare a glowing bed of charcoal in the bottom and this will completely cover the metal until it is ready to be poured into the mold, when the charcoal can be skimmed off. After the metal is all in the ladle and the mixture has been added and thoroughly stirred, add 5 ounces of phosphor-copper per 100 pounds of metal to the bronze as a deoxidizer to avoid porosity.

Alloy Shrinkages

Kindly let me know what the shrinkages are of the following alloys: No. 12 *aluminum, Parson's manganese bronze, yellow brass and red brass.*

The shrinkages of castings made from alloys given in your inquiry follow: Aluminum, 17/64-inch per foot; manganese bronze, ¼-inch per foot; yellow brass, 3/16-inch per foot, and red brass, 1/6-inch per foot.

Aluminum Alloy No. 31

Will you kindly give us the analysis of aluminum alloy No. 31?

The analysis of aluminum No. 31 follows: Copper, 3 per cent; zinc, 15 per cent; manganese, 0.5 per cent and the balance aluminum.

Removal of Aluminum from Turnings

What is the best flux to use as a deoxidizer for aluminum turnings mixed in brass borings? Can the effect of aluminum on the mixture be eliminated entirely? We are making castings weighing about two pounds, but recently the red brass mixture of which they are made indicates shortness. The castings are intended as ears on positive pressure blower paddles. These have holes drilled into the tail and the center to admit inserting steel paddles. So far as the eye can detect, the castings are perfect, sound and of good color, but when they are being riveted they crack on one side of the tail piece. The mixture consists of 40 *per cent of copper punchings and the balance pig copper or red brass borings. The borings, of course, are pigged and remelted. The mixture also contains two pounds of lead.*

Probably the easiest way to remove aluminum turnings mixed with brass turnings is by the use of some acid that will not dissolve the brass. Dilute solutions of either hydrochloric or hydrofluoric acids may be employed, the latter probably giving the best results. If the acids are not readily obtainable, try a strong solution of lye. Permit the borings to remain in the lye until the aluminum has been disintegrated, then wash the borings thoroughly in

water. The borings can be dried before being melted, but this is not absolutely necessary if a little care is exercised in charging. When aluminum is melted with brass, it can be removed, but the operation, while easy of accomplishment to a metallurgist versed in alloy practice, is difficult for others and therefore it will not be described, as failures surely would follow in an attempt to remove the aluminum.

To prevent cracking, we suggest that the lead be omitted from your mixture and twice the amount of zinc be substituted therefor.

Shrapnel Shell Sockets

We have received an order for shrapnel shell sockets which are to meet the following specifications: Yield point, 6 tons; breaking point, 12 tons; and 10 per cent elongation. These specifications are the minimum and the test bars are to be 7 inches long and 1 inch in diameter. The only information which we have regarding the metal from which these sockets should be made is that it must be a high-zinc mixture which must not contain more than 1 per cent of lead.

Manganese bronze is the alloy generally used for making shell sockets and before starting it would be well to investigate the sources of your zinc supply. The specifications which provide for less than 1 per cent of lead, while ordinarily easy to meet, cannot so readily be met at the present time. You should obtain a supply of zinc containing less than 2 per cent of lead. A consignment of spelter recently received by one manufacturer was found to contain nearly 4 per cent of lead and some of the ingots contained 5 per cent, but this amount, of course, was visible. The following mixture will meet the requirements and will allow a considerable margin of safety: Copper, 56 per cent; manganese-copper, 2 per cent; zinc, 41 per cent; tin, ½ per cent: and aluminum, ½ per cent. A riser on the center of the test bar and in the cope, will materially improve the castings. These sockets are cast in chill molds.

Aluminum Alloy for Matchplates

In making a mixture for matchplates would it be satisfactory to use 92 per cent aluminum and 8 per cent of copper wire, the latter to be added to the melted aluminum, mixing it by pouring from one crucible to another? Also let us know whether this mixture can be used direct for making matchplates or whether it is advisable to cast it into ingots and then to remelt the alloy for match-plate purposes.

While copper is satisfactory for your mixture, it might be more advisable to make the aluminum alloy in the regular manner, although it can be done as outlined by you. The method of melting the two metals and pouring one into the other is somewhat tedious. The usual practice of making the alloy is first to produce a hardening mixture consisting of 50 per cent aluminum and 50 per cent copper. This can be done easily by melting the copper and adding the aluminum in the form of small pieces, stirring thoroughly to incorporate the two metals. This alloy is brittle and can be broken into pieces of convenient size for adding to the aluminum when making the 92 and 8 alloy. Use 84 pounds of aluminum, 16 pounds of hardener, and melt together. This adds 8 per cent of copper to the aluminum, giving you the No. 12 alloy. The mixture can be used direct when made in the manner outlined.

Team Work in a Brass Plant

By P W Blair

UP-TO-DATE brass manufacturing plants, and more especially the plants manufacturing plumbing, steam, gas and waterworks brass goods, have in the past few years installed many of the latest and most up-to-date tools and machines for the production of their goods, with the result that the quality and diversity of the latter have increased in proportion, allowing the manufacturers to compete in the markets of the world and enjoy a large export trade. The brass manufacturing plant, viewing it from all points, presents an unique problem in the mechanical line. The process of work in the machine shop finishing departments or pattern shops is more or less mechanical and because of this, individual ability stands out more prominently than in the foundry or plating room. Mechanical ability is not, however, lacking in the foundry or plating room and if the work produced were dependent only on the skill of the individual molder or plater, the efficiency of these departments would measure up equal at least to the other branches of the plant. The production of castings from the foundry and of goods from the plating room, however, is not only dependent on a mechanical process of ability, but also on a chemical process. Even with the most up-to-date methods it is impossible to individualize mechanical ability, or with any degree of certainty to fix the responsibility for defective work, and yet there is reason for the loss of every spoiled casting or defective piece of work. Some one of the departments failed in performing its part of the work correctly.

As an illustration we will consider the problem of defective castings. They may have been due to the careless work of the molder in making the mold or pouring it, or they may have been due to lack of care on the part of the coremaker in making or venting the core. It may have been due to poor judgment in the selection of sand not suited to the class of work to be produced or it may have been due to poor tools or appliances. A purchasing agent, in order to save a few dollars, may buy poor grade materials, such as copper or scrap which contains aluminum, and which, through ignorance on the part of the melter, might be used on fittings or body parts of castings, the castings proving a failure when subjected to the hydraulic test after all the expense of labor had been expended on them. Again, the error may have been caused by poor furnace practice. The fault has been somewhere and a systematic search or inquiry should reveal the cause and fix the responsibility. In the other departments of a brass manufacturing plant, aside from the foundry, mechanics can forge ahead of their fellows and become experts in their particular line. They can individualize their work and reap the benefit of their skill. In the foundry, however, all the skill possible for the molder to possess could not prevent the loss of his work if the other units of the department failed to do their part with equal skill. The foundry is in a class by itself in the mechanical world. Instead of working for individual records, team-work must be established. Every employe, every unit must work and co-operate with but one purpose in mind, the success of the department in the production of perfect work—not part of the time, but all the time. When the machine or finishing department receives perfect castings it is enabled to reduce the cost of manufacture from 10 to 20 per cent, because true castings are machined more rapidly and are handled with ease, as they fit the jaws of chucks or jigs and can be polished at a great saving.

A certain portion of the work in a foundry is entrusted to unskilled help, to men who do not understand the necessity of following out to the letter the instructions given them, who cannot see how far-reaching the effects of their indifferent work may be, what loss it may cause, or the wrong reflection it may cause on the ability of the molder. Such men cannot be blamed for some-

thing they do not know, but they can be helped and taught to perform their part of the work as well as the necessity of attaining perfection in it.

To emphasize the necessity for team work in a brass manufacturing plant, a lesson can be learned from watching a game of football. The writer witnessed two of the leading state university teams engage in their annual struggle last year. The success of any football team is dependent first upon skill and second upon team-work, the latter being just as necessary as the former. The greatest responsibility in a football game rests with the backs, but let them be ever so skilled, they will go down to defeat if the other units of the team do not support them. In the game to which I refer, the lightweight team with its team-work and co-operation of its defense was able to defeat a highly skilled individual team of players in one of the greatest state college games of the season.

There is no reason why any brass manufacturing plant cannot be brought up to as high a state of skill and perfection as any other up-to-date plant. All it requires is to adopt the team-work idea and install an educational system that will bring the various working units up to a thorough understanding of their duties. Every man must be taught to recognize and understand the responsibility of his work and to do it along this line. Every unit of these departments must be impressed with the fact that some one man's work, if improperly performed, will lead to the loss of some particular job.

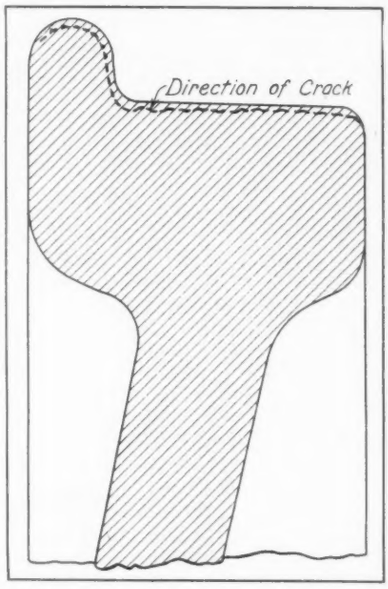
The old foundry slogan, *any molder is liable to lose a casting,* was not coined because of a desire on the part of the molder to admit that he lacked mechanical ability, but because it has always been recognized that too many things entered into the production of his work, some of which might prove faulty. Molders, as a result, have recognized that they were individually helpless in their efforts to be perfect. It is a big task to bring about perfection in a brass manufacturing plant and more especially in the foundry, but it can be done and up-to-date plants will do it for economic reasons as well as for raising the efficiency of the molder up to a level with the mechanics in other departments of the plant. That the molders would give such a move their hearty support goes without saying. They would hail with delight any system that would help them to attain greater perfection and relieve them of the strain of carrying the burden of responsibility for the production of defective castings, for which in the majority of cases they are not responsible.

The men in viewing this question must get one thought imbedded in their minds. If a molder is not wholly to blame for poor castings, then from the same viewpoint, he is not deserving of all the credit for perfect work. The same factors that entered into the production of the imperfect castings were apparent in the production of the perfect work except that in the latter case men worked in unison and perfect team-work was the result. He must recognize that in the face of all the skill he may possess and display in his work his efforts may go for naught because of the lack of skill displayed by one or more of his team-mates and whose efforts are just as essential as his own for the success of the work produced.

Shrinkage Cracks in Car Wheels

By W. J. Keep

Question:—We are experiencing a good deal of trouble in casting chilled car wheels. At present we are using a mixture of 60 per cent English hematite pig iron, the analysis of which is silicon, 2 per cent; manganese, 0.72 per cent; sulphur, 0.03 per cent and phosphorus, 0.04 per cent. Used with this is 20 per cent scrap wheels and 20 per cent mild steel scrap.



SHRINKAGE CRACK IN CAR WHEEL

The cupola charge is made according to the following analysis: Silicon, 1 per cent; manganese, 1.30 per cent; sulphur, 0.06 per cent, and phosphorus, 0.06 per cent. The manganese in the charge is increased by manganese steel scrap containing 12 per cent manganese.

Our cupola is lined to 27 inches and is supplied with air from a Roots blower, with a 10-inch outlet, running at 360 revolutions per minute. The furnace has six tuyeres which are 5 x 4 inches on the outside and 12 x 3 inches on the inside.

When starting, the pressure records five ounces and we have cast these wheels with both hot and cold metal and with the chillers both cold and hot, but we always have the same results. The wheels have cracks on the treads. The cracks extend to the bottom of the chill, leaving a gap ¼-inch in width. The chill is always about the same depth. The crack extends from near the top of the flange across the chill to the inside edge of the tread. We would like to know what mixture you advise and whether the wheels should be cast hot or cold.

Answer:—The iron has too great a shrinkage. This comes from the very low carbon resulting from the steel scrap and from the high manganese. Your practice differs so greatly from that in America that I will place your wheel analysis alongside of what we would consider good.

	Your wheel, per cent.	American railroad car wheel, per cent.
Silicon	1.00	0.60 to 0.70
Sulphur	0.06	0.08 to 0.10
Phosphorus	0.06	0.30 to 0.40
Manganese	1.30	0.50 to 0.60
Combined carbon	....	0.60 to 0.80
Total carbon	....	3.50 to 3.70

Your wheels, being smaller than ours, may require more silicon, but you had better try to get the percentage of sulphur, phosphorus, manganese, combined carbon and total carbon the same as our wheels. To do this, you will have to use more pig with lower silicon and less steel. I would suggest imported car wheel scrap, but your cupola is too small for any heavy or irregular scrap. Manganese does not add to the chill. It simply hardens the castings and increases the shrinkage. I would leave out the manganese steel scrap.

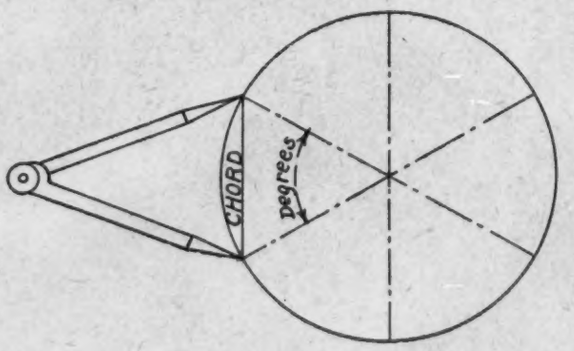
The Ingersoll-Rand Co., New York City, has established a branch office at 139 Townsend street, San Francisco. Harron, Rickard & McCone, who have been the Ingersoll-Rand agents on the Pacific coast, will continue to co-operate with the Ingersoll-Rand Co. in the sale of its machinery. H. L. Terwilliger has been appointed district manager for the territory covered by the San Francisco and Los Angeles offices, with headquarters at San Francisco as indicated.

The Boston office of the Sullivan Machinery Co., Chicago, has been removed from 35 Federal street to the Unity building, 185 Devonshire street.

The Mt. Pleasant Iron Foundry, Inc., New Bedford, Mass., has been incorporated with $8,800 capital stock.

Table For Spacing Off Circles

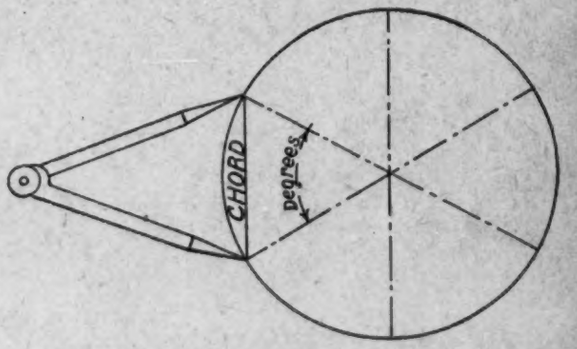
By Arthur McAlpine



No. of p'rts.	Deg.— min.	Length of Chord for Following Diameters 1	2	3	4	5	6	7	8	9	10	11	12	13	14
3	120 00	0.866	1.732	2.598	3.464	4.330	5.196	6.062	6.928	7.794	8.666	9.526	10.392	11.258	12.124
4	90 00	0.707	1.414	2.121	2.828	3.536	4.243	4.950	5.657	6.364	7.081	7.778	8.485	9.192	9.900
5	72 00	0.588	1.176	1.763	2.351	2.938	3.527	4.115	4.702	5.290	5.878	6.465	7.053	7.641	8.229
6	60 00	0.500	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500	5.000	5.500	6.000	6.500	7.000
7	51 26	0.434	0.868	1.302	1.736	2.170	2.604	3.037	3.471	3.905	4.339	4.773	5.207	5.641	6.075
8	45 00	0.383	0.765	1.148	1.531	1.913	2.296	2.679	3.061	3.444	3.827	4.210	4.592	4.975	5.358
9	40 00	0.342	0.684	1.026	1.368	1.710	2.052	2.394	2.736	3.078	3.420	3.762	4.104	4.446	4.788
10	36 00	0.309	0.618	0.927	1.236	1.545	1.854	2.163	2.472	2.781	3.090	3.399	3.708	4.017	4.326
11	32 44	0.282	0.564	0.845	1.127	1.409	1.691	1.973	2.254	2.536	2.818	3.100	3.381	3.663	3.946
12	30 00	0.259	0.518	0.776	1.035	1.294	1.553	1.812	2.069	2.329	2.588	2.847	3.106	3.365	3.624
13	27 42	0.239	0.479	0.718	0.958	1.197	1.436	1.676	1.915	2.154	2.394	2.633	2.873	3.112	3.352
14	25 43	0.222	0.445	0.667	0.890	1.112	1.334	1.557	1.779	2.000	2.224	2.446	2.669	2.891	3.114
15	24 00	0.208	0.416	0.624	0.832	1.040	1.247	1.455	1.663	1.871	2.079	2.287	2.495	2.703	2.901
16	22 30	0.195	0.390	0.585	0.780	0.975	1.171	1.366	1.561	1.756	1.951	2.146	2.341	2.536	2.731
17	21 10	0.184	0.367	0.551	0.735	0.918	1.102	1.286	1.469	1.653	1.837	2.020	2.204	2.388	2.571
18	20 00	0.174	0.347	0.521	0.695	0.868	1.041	1.216	1.389	1.563	1.737	1.910	2.084	2.257	2.431
19	18 56	0.164	0.329	0.493	0.658	0.822	0.987	1.151	1.316	1.480	1.645	1.809	1.974	2.137	2.303
20	18 00	0.156	0.318	0.469	0.626	0.782	0.937	1.095	1.251	1.408	1.564	1.721	1.877	2.033	2.190
21	17 8	0.149	0.298	0.447	0.596	0.745	0.894	1.043	1.192	1.341	1.489	1.639	1.788	1.936	2.085
22	16 21	0.142	0.286	0.427	0.569	0.712	0.855	0.996	1.139	1.281	1.423	1.566	1.708	1.850	1.993
23	15 39	0.136	0.273	0.409	0.545	0.681	0.818	0.954	1.092	1.227	1.363	1.499	1.635	1.772	1.908
24	15 00	0.130	0.261	0.392	0.522	0.653	0.783	0.914	1.044	1.175	1.305	1.436	1.566	1.697	1.827
25	14 24	0.125	0.251	0.375	0.501	0.627	0.752	0.877	1.003	1.128	1.253	1.379	1.504	1.629	1.755
26	13 50	0.120	0.241	0.361	0.482	0.602	0.723	0.843	0.963	1.084	1.204	1.325	1.445	1.566	1.686
27	13 20	0.116	0.232	0.348	0.464	0.580	0.697	0.813	0.929	1.045	1.161	1.277	1.393	1.509	1.625
28	12 51	0.112	0.224	0.336	0.448	0.560	0.672	0.784	0.896	1.008	1.121	1.233	1.345	1.457	1.569
29	12 24	0.108	0.216	0.324	0.432	0.540	0.648	0.756	0.864	0.972	1.080	1.188	1.296	1.404	1.512
30	12 00	0.104	0.209	0.314	0.418	0.522	0.627	0.732	0.836	0.941	1.045	1.150	1.254	1.359	1.463
31	11 37	0.101	0.202	0.303	0.404	0.505	0.606	0.707	0.808	0.910	1.011	1.112	1.213	1.314	1.415
32	11 15	0.098	0.196	0.294	0.393	0.491	0.589	0.687	0.785	0.883	0.982	1.080	1.178	1.276	1.374
33	10 55	0.095	0.190	0.285	0.380	0.475	0.570	0.665	0.760	0.855	0.949	1.045	1.140	1.235	1.330

Table For Spacing Off Circles

By Arthur McAlpine



No. of parts.	Deg.— min.	Length of Chord for Following Diameters 15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.
3	120 00	12.99	13.86	14.72	15.59	16.45	17.32	18.19	19.05	19.92	20.78	21.65
4	90 00	10.61	11.31	12.02	12.73	13.43	14.14	14.85	15.55	16.26	16.97	17.68
5	72 00	8.82	9.41	10.00	10.58	11.17	11.76	12.35	12.94	13.52	14.11	14.70
6	60 00	7.50	8.00	8.50	9.00	9.50	10.00	10.50	11.00	11.50	12.00	12.50
7	51 26	6.51	6.94	7.38	7.81	8.25	8.68	9.11	9.55	9.98	10.42	10.85
8	45 00	5.75	6.13	6.51	6.89	7.28	7.66	8.04	8.43	8.81	9.19	9.58
9	40 00	5.13	5.47	5.81	6.16	6.50	6.84	7.18	7.52	7.78	8.21	8.55
10	36 00	4.64	4.94	5.25	5.56	5.87	6.18	6.49	6.80	7.11	7.42	7.73
11	32 44	4.23	4.51	4.79	5.08	5.36	5.64	5.92	6.20	6.49	6.77	7.05
12	30 00	3.89	4.14	4.40	4.66	4.92	5.18	5.44	5.70	5.96	6.22	6.48
13	27 42	3.59	3.82	4.07	4.30	4.54	4.78	5.02	5.26	5.50	5.74	5.98
14	25 43	3.33	3.55	3.77	4.00	4.22	4.44	4.66	4.88	5.11	5.33	5.55
15	24 00	3.12	3.33	3.54	3.74	3.95	4.16	4.37	4.58	4.78	4.99	5.20
16	22 30	2.93	3.12	3.32	3.51	3.71	3.90	4.10	4.29	4.49	4.68	4.88
17	21 10	2.76	2.94	3.13	3.31	3.50	3.68	3.86	4.05	4.23	4.42	4.60
18	20 00	2.61	2.78	2.96	3.13	3.31	3.48	3.65	3.83	3.95	4.18	4.35
19	18 56	2.46	2.64	2.81	2.97	3.14	3.30	3.44	3.61	3.77	3.94	4.10
20	18 00	2.34	2.50	2.65	2.81	2.96	3.12	3.28	3.43	3.59	3.75	3.90
21	17 8	2.24	2.38	2.53	2.68	2.83	2.98	3.13	3.28	3.43	3.58	3.73
22	16 21	2.13	2.27	2.41	2.56	2.70	2.84	2.98	3.12	3.27	3.41	3.55
23	15 39	2.04	2.18	2.31	2.45	2.58	2.72	2.86	2.99	3.13	3.26	3.40
24	15 00	1.95	2.08	2.21	2.34	2.47	2.60	2.73	2.86	2.99	3.12	3.25
25	14 24	1.88	2.00	2.13	2.25	2.38	2.50	2.63	2.75	2.88	3.00	3.13
26	13 50	1.80	1.92	2.04	2.16	2.28	2.40	2.52	2.64	2.76	2.88	3.00
27	13 20	1.74	1.86	1.97	2.09	2.20	2.32	2.44	2.55	2.67	2.78	2.90
28	12 51	1.68	1.79	1.90	2.02	2.13	2.24	2.35	2.46	2.58	2.69	2.80
29	12 24	1.62	1.73	1.84	1.94	2.05	2.16	2.27	2.38	2.48	2.59	2.70
30	12 00	1.56	1.66	1.77	1.87	1.98	2.08	2.18	2.29	2.39	2.50	2.60
31	11 37	1.52	1.62	1.72	1.82	1.92	2.02	2.12	2.22	2.32	2.42	2.53
32	11 15	1.47	1.57	1.67	1.76	1.86	1.96	2.06	2.16	2.25	2.35	2.45
33	10 55	1.43	1.52	1.62	1.71	1.81	1.90	2.00	2.09	2.19	2.28	2.38

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note-book form.

THE FOUNDRY DATA SHEET, JULY, 1915

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

A New Foundry for Making Machinery Castings

Equipment of the New Shop of the Putnam Machine Co., Fitchburg, Mass., and How It is Arranged

ON SATURDAY, June 26, the Putnam Machine Co., Fitchburg, Mass., now owned and controlled by Manning, Maxwell & Moore, Inc., New York, formally opened its new shop for the inspection of the foundrymen of New England. This plant, which commenced operating only a few weeks ago, easily takes rank among the most up-to-date and thoroughly equipped casting plants in New England. Among the many novel and interesting features embodied in its construction, perhaps the most interesting is the ventilating system. In addition to the liberal use of steel window sash fitted with operating devices, and the employment of the usual roof ventilators, a system is provided which is capable of entirely exhausting the air from the foundry every 10 minutes. This system effectually eliminates the old foundry trouble of murky atmosphere due to an accumulation of smoke and gases.

A large galvanized sheet steel pipe or duct is located under the monitor near the roof and is connected to a large exhaust fan. The duct is provided with a number of openings, the size of which can be adjusted by means of vanes or gates. The fan, which is motor-driven, exhausts the air from the duct, and, in turn, from the foundry, and discharges it into the atmosphere. This apparatus also may be employed for heating the foundry by inducing air through a series of specially designed cast iron radiators and passing it into the shop at a height of about 10 feet from the floor.

The foundry is equipped with two cupolas. One, of the Whiting type, is 68 inches in diameter, with a capacity of 18 tons per hour. The other cupola is of the Colliau type and is 42 inches in diameter. The larger cupola is provided with a charging machine, while the smaller one is charged by hand. The blast for the larger cupola is provided by a positive-pressure blower of the Wilbraham-Green type, while that for the smaller cupola is furnished by a Sturtevant fan. Both blowers are motor-driven. The blast is measured by the use of a Clark meter. The iron is taken from the cupolas in bull-ladles which are transferred to the floors by a crane.

Several interesting features are found in the cupola charging department. The storage yard alongside the foundry is commanded by a 5-ton electric traveling crane of the Shaw type, which has a span of 100 feet and is mounted on a runway 325 feet long. Through the yard, parallel to the foundry, runs the receiving track. The pig iron is unloaded with a magnet. Both the pig iron and coke are elevated, as required, to the charging floor, which projects out into the yard and is commanded by the crane. The projecting portion of the charging platform is partitioned into a number of bins for separating the various grades of pig iron; the coke is dumped into a special bin in one corner. A number of steel trucks are provided for handling the material, there being eight for pig iron and four for coke. They are fitted with swing-ing side doors, so that the contents may readily be discharged into the larger cupola by means of the charging machine. The charging platform is equipped with two Fairbanks dial scales of the springless type, which are provided with platforms that are flush with the floor. The scales are located in front of the pig iron bins and extend almost entirely across the charging platform. Thus the work of loading a truck with the proper proportions of each grade of pig iron for a given mixture is rendered very simple; it only is necessary to roll the truck along, taking on as much iron at each pile as is desired.

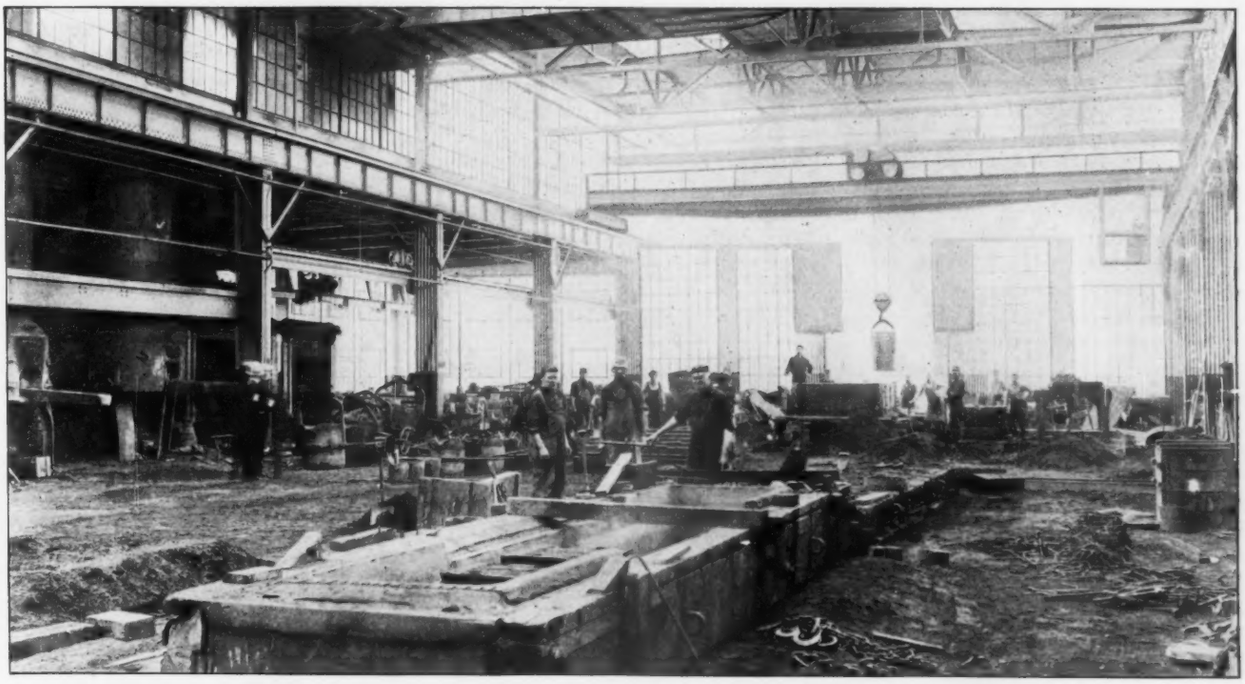


FIG. 1—MAIN AISLE IN PUTNAM MACHINE CO.'S FOUNDRY, SHOWING CUPOLA AND CORE DEPARTMENTS, ALSO SHOWING OPENING IN END OF BUILDING FOR RUNNING CRANE OUT INTO YARD

FIG. 2—ANOTHER VIEW OF THE FOUNDRY SHOWING MONITOR SKYLIGHTS AND DUCT FOR EXHAUSTING SMOKE AND GASES

FIG. 3—A VIEW OF THE NORTH BAY, SHOWING BENCH MOLDERS' FLOORS

Foundry scrap is brought to the charging floor by means of a 1-ton elevator.

Molding sand, core sand, facing, clay, gravel, etc., are stored in a concrete cellar, 29 x 74 feet in size, located beneath the foundry. The materials are discharged into this cellar through chutes. The cellar communicates with the foundry by means of a spiral stairway and a hatchway. When sand is required, it is loaded into a specially designed bucket, of which there are a number, and hoisted into the foundry by a crane.

The cellar also contains three coke-burning furnaces for furnishing heat to the core ovens, which are located in the south bay of the foundry. These ovens are of the Whiting type and two are equipped with heat ports provided with sliding covers. The ports are located at the front and back of each oven and the sliding covers permit the concentration of the heat either at the back or front of the oven, as desired. By opening both ports, of course, uniform distribution of the heat may be had throughout the oven. The ovens are provided with the usual flues at the bottom of the side walls, and with top flues; the latter are kept only open long enough to allow the escape of the vapor and smoke which accumulate at the beginning of a bake. These ovens are each 10½ x 16 x 8 feet, the height being given last; they are designed to accommodate four trucks each, two abreast. A third Whiting core oven, 6-1/3 x 7½ x 8 feet in size, in addition to accommodating a buggy, contains a 2 x 6-foot alcove, which is fitted with a rack. In addition, the core department contains two drawer type Whiting ovens. This department further is equipped with a 15 x 15-inch jolt machine, for ramming cores, and with a 5-ton hand-operated crane for loading the core trucks.

The cleaning department is located in the south bay of the foundry. It contains a Paxson sand blast apparatus, and two tumbling barrels, 36 x 48 inches and 48 x 72 inches, respectively. A 5-ton hand-operated crane shortly will be added to the equipment in the cleaning room. The south bay also contains a brass foundry; it is equipped with three crucible pit furnaces. In addition, this bay contains a locker and wash-room for the molders. The main and north bays are given up to molding purposes. The main bay is commanded by two Shaw 10-ton and 20-ton electric cranes. They are mounted on a runway which extends out into the flask storage yard for a distance of 100 feet. The north bay is equipped with a 3½-ton Shaw crane and a monorail system. Additional small cranes will be installed in the future. The company is making preparations to use molding machines more extensively than in the past. The molding machines now in use embrace a combination jolt, roll-over and pattern-drawing machine of the Herman type, and a similar machine of the Osborn type; the former is fitted with a 24 x 30-inch, and the latter a 30 x 54-inch table. Work has been commenced on the installation of a 50 x 50-inch Herman jolter. The output of the foundry consists almost entirely of castings for use in the construction of machine tools. The Putnam Machine Co. has been located in Fitchburg since 1838. The old plant, which has stood since 1866, will soon be torn down to make room for a street which the city will cut through.

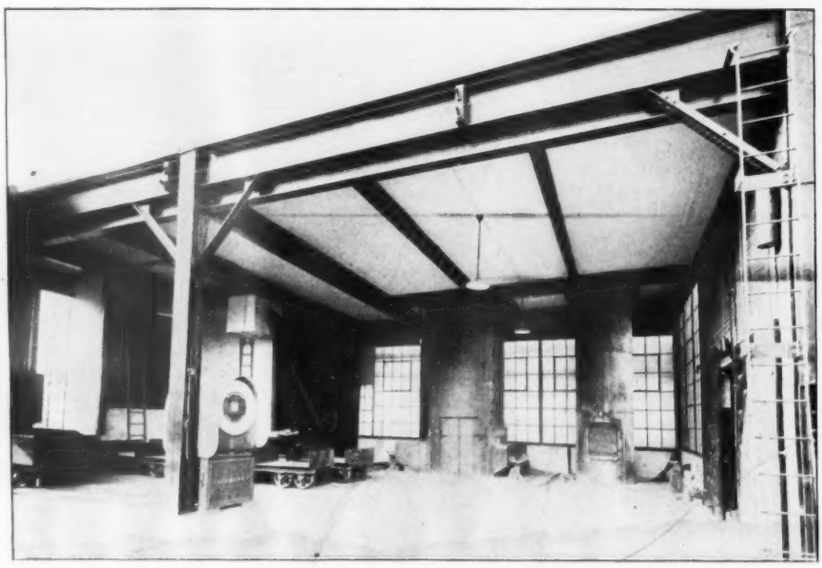


FIG. 4—CHARGING FLOOR, SHOWING CHARGING MACHINES, SCALES, TRUCKS, ETC.

Welding Scrap Nickel Anodes

SOME important experiments in welding nickel anodes by the oxy-acetylene process recently have been concluded in the plating department of the Prest-O-Lite Co.'s Indianapolis plants. As a result of these tests, worn nickel anodes which have previously been scrapped and sold at less than half price are now being reclaimed at a saving of more than 100 per cent.

The anodes used by the Prest-O-Lite Co. are castings containing 90 per cent nickel, 8 per cent carbon and 2 per cent iron. They are elliptical bars, approximately 1½ x 3½ inches cross-section and 30 inches long, and weigh about 30 pounds. Their market value varies between 46 and 50 cents per pound. On the basis of the latter price, each 30-pound anode has a value of $15. By welding old anodes which have been in the solution, and which have a junk value of between 22 and 25 cents per pound, the Prest-O-Lite Co. is now converting its entire pile of scrap nickel into what are practically new anodes at a total cost for gas and labor of less than 6 cents per pound. This estimate is based on a recent test at Indianapolis, in which 421 pounds of scrap anodes were welded at the following costs:

463 cu. ft. oxygen (at 2c)	$ 9.26
480 cu. ft. acetylene (at 2c)	9.60
24 hours labor, (at 25c)	6.00
Total	$24.86

In view of the fact that this test was made before experience in the operation had been gained, it is apparent that better results and greater savings are sure to be the result of practice.

The method of handling this operation is about as follows: As the anodes are eaten away by the solution they are turned over to an oxy-acetylene welder who tacks on scraps of old anodes by welding to increase the surface. One, two, three and sometimes four pieces of scrap are welded on, as shown in the accompanying illustration, depending on the size and weight desired. The welding flame also is employed to remove the brass hooks which are used to support the anodes while in solution. Under the intense heat of the oxy-acetylene flame, approximately 6,300 degrees Fahr., the solder melts rapidly, leaving a pure nickel bar, which is later welded.

Thus, by the addition of from 5 to 15 pounds or more of scrap nickel, a brand new anode is manufactured at trifling cost and every bit of scrap is utilized without the loss of a single pound of metal. No flux is employed, as this has been found to be unnecessary. The pieces of scrap are simply melted on or fused together, using another piece of nickel as a filling rod. The welding process is a great benefit in obtaining perfect fusion which is essential, as all joints must have electrical conductivity equal to that of new anodes. Another great advantage is the fact that no skill or experience in the art of oxy-acetylene welding is required to weld scrap nickel anodes; in fact, any workman with average intelligence can do the work without previous knowledge of the process. The apparatus required to do the work is inexpensive. Many previous attempts have been made to utilize scrap nickel anodes, the most common practice being to drill holes through several pieces and bind them together by means of lead rivets.

HOW SCRAP NICKEL ANODES ARE WELDED BY THE OXY-ACETYLENE PROCESS

This method depends upon the contact of the wire or rivet and the piece of scrap to conduct the current and is, therefore, of uncertain value, and in many cases a flat failure. If, for any reason, the contact is bad and offers too much resistance to the current of electricity, the metal might or might not dissolve. Therefore, by using the welded anodes as much scrap as desired may be used in a tub without danger of depleting the solution of metal.

The welding process solves an important problem in the nickel-plating industry, as hundreds of tons of scrap nickel anodes can now be utilized at the same value as new anodes and at trifling cost. The Prest-O-Lite Co. estimates that more than a ton a year of scrap anodes can be used in its plating department.

Annual Meeting of Electroplaters' Society

THE THIRD annual meeting of the American Electroplaters' Society, held at Dayton, O., June 3 to 5, was well attended and the exhibition of plated work as well as platers' supplies and accessories proved an exceedingly interesting feature. The evening sessions, or round table discussions, were held at the Algonquin hotel, the headquarters of the society during the convention. The business sessions were held and the exhibits were made in the Hall of Industrial Education at the plant of the National Cash Register Co.

A large number of exceedingly interesting papers were presented and one feature frequently referred to indicated a tendency toward greater concentration of the electrolyte. Walter S. Barrows, Toronto, Ont., presented a paper entitled "The Commercial Aspects of Cobalt Electroplating". A magnificent display of specimens plated with cobalt was made and this consisted of brass, iron, copper, steel, lead, pewter and tin. The specimens were arranged upon an American shield covered with velvet and decorated with a hand-painted American eagle surmounted by the stars and stripes. A Canadian shield decorated with a hand-painted beaver surmounted by the Union Jack and the British crown carried specimens of ores such as smaltite, erythrite and cobalt bloom, also cobalt and nickel black and gray oxides. Pure cobalt anodes were shown, together with the salts and solutions used in the preparation of two practical, rapid cobalt plating solutions explained in the paper presented by Mr. Barrows. Current densities from 150 to 350 amperes per square foot may be used with these solutions, the plates being extremely hard, although easily finished. The hard, fine-grained structure of these cobalt deposits render it equal to a comparatively thick nickel deposit. Plates satisfactory for all ordinary purposes were produced in from one to three minutes. The discussion also indicated that concentrated nickel solutions are becoming popular among platers.

Among the papers presented were the following: "Copper Solutions," by George B. Hogaboom, New Britain, Conn.; "Single Nickel Salt Solutions and Results Obtained," by E. W. Heil, Wichita, Kan.; "A Genuine Rapid Nickel Plating Solution," by E. S. Thompson, Chicago; "Plating Room Common Sense," by H. J. Ter Doest, Akron, O.; "A Review of 1914 Accomplishments," by Joseph Walters, Richmond, Va.; "Experiments With Cobalt Plating Solutions," by Messrs. Buchanan and Haddow, New York. Dr. William Blum, of the United States bureau of standards, described the work that is being done by that government department.

WALTER S. BARROWS

Walter S. Barrows, who was elected president of the American Electroplaters' Society, at its Dayton, O., meeting, is one of the foremost exponents of the admixture of science with practice in plating operations. His experience dates back a quarter of a century when he became connected with the H. A. Lozier Mfg. Co., Toledo, O., subsequently being appointed manager of the Canadian branch of this company in 1895. The plated product of this plant attracted wide attention throughout Canada and in foreign countries, particularly for its beauty and durability. In 1900 Mr. Barrows was given supervision of the entire plating output of the amalgamated bicycle factories of Canada and now is foreman electroplater for the Canada Cycle & Motor Co. and the Russell Motor Car Co., Toronto. Mr. Barrows became a member of the National Electroplaters' Association in 1911 and in 1913 assisted in the reorganization of the society, when he was elected second vice president. He has contributed freely to the literature on the electro-deposition of metals, his articles and replies to inquiries being familiar to the readers of *The Foundry*.

Exhibits of plated work, platers' supplies and accessories were made by the following: H. E. Willmore, Chicago, bronze finishes; L. Schmidt, Chicago, fancy coloring; Tip Top Stove Co., Richmond, Va.; W. R. Parsons, Chicago; Fauscher Bros., Dayton, O.; Hoken Bros. Supply Co., St. Louis; Dayton Computing Scale Co., Dayton, O.; Dayton Plating Co., Dayton, O.; Thomas Buchanan Co., Cincinnati, O.; Stanley Mfg. Co., Dayton, O.; plated stove leg exhibit by the St. Louis members of the society; Haven Malleable Iron Co., Cincinnati; Keeler Bros., Grand Rapids, Mich., and the Cincinnati Coffin Co., plated specimens.

Several demonstrations were made by some of the members in the plating department of the National Cash Register Co., the entire plant, at all times, having been at the disposal of the members of the organization. On Saturday morning the delegates visited the Delco, Dayton Computing Scale and the Davis Sewing Machine Co. plants. In the afternoon a "seeing Dayton" trip was enjoyed and numerous points of interest were visited. The convention closed with a banquet on Saturday evening.

Officers

Officers for the ensuing year were elected as follows: W. S. Barrows, Russell Motor Car Co., Toronto, Ont., president; H. H. Williams, St. Louis, first vice president; W. G. Stratton, Bassick Co., Bridgeport, Conn., second vice president; Walter Frain, superintendent, plating department National Cash Register Co., Dayton, O., secretary-treasurer, and Joseph H. Hansjosten, Kokomo, Ind., editor of the *Monthly Review*.

The next convention of the American Electroplaters' Society will be held at Toronto, Ont., in July, 1916.

S. Fair & Son, Inc., Saginaw, Mich., have placed a contract with the Snyder Electric Furnace Co., Chicago, for the installation of an electric furnace which will have an output of eight tons of refined steel in 24 hours. The furnace will be operated on cold stock and vanadium steel will be manufactured.

The Mauston Aluminum Co., established three years ago at Mauston, Wis., has decided to retire from the field.

Foundrymen Prepare for Atlantic City Meeting

Partial List of Papers That Will Be Presented Before the American Foundrymen's Association—The Exhibition Features

FOUNDERS' week, the great annual event of American manufacturers of castings, will be celebrated this year at Atlantic City, during the week of Sept. 27. The occasion will be marked by the annual meetings of the American Foundrymen's Association and the American Institute of Metals as well as the yearly exhibit of foundry supplies and equipment conducted under the auspices of the Foundry & Machine Exhibition Co. Heretofore the Associated Foundry Foremen have held their meetings during this week, but since this organization has dissolved and its members have become affiliated as associates with the American Foundrymen's Association, they will take part in the deliberations of this society.

The program of the American Foundrymen's Association, while yet incomplete, already has assumed large proportions and to permit of full discussion of the many valuable papers that will be presented, two simultaneous sessions on malleable and steel castings will be held. The business meeting, which heretofore followed the close of the technical deliberations, will be held on Wednesday evening, Sept. 29, when the new officers will be elected and the business affairs of the association will be discussed.

An exceedingly gratifying increase in membership has been recorded during the year, the enrollment now approximating 1,000, of which more than 150 are associates. The campaign for new members resulted in the addition of nearly 100 new names and at the annual meeting it is believed a still further growth will be reported. Financially the society is in better condition than at any time in its history, and the balance in the treasury will permit of increasing the scope of the work that is now being carried on.

A partial list of papers that will be presented, follows:

"Resume of Advances in Foundry Practice", by Richard Moldenke.

"Application of Various Types of Molding Machines to Different Classes of Work", by I. J. Wilson and A. O. Backert.

"Time Studies on Molding Machines", by H. K. Hathaway, Philadelphia.

"Functions of Sand Binders" by H. M. Lane, Detroit.

"The Reclamation of Molding Sand", by W. M. Saunders and H. B. Hanley.

"Relation of the Foundry Foreman to the Manager", by S. V. Blair.

"Manufacture and Constitutents of Pig Iron and the Essentials in the Purchase of this Material", by O. J. Abell, Chicago.

"Pouring Systems for Gray Iron Shops", by H. Cole Estep.

"Fuel Oil Cupolas", by Bradley Stoughton, New York City.

"Thermal Reactions in Melting Gray Iron", by Dr. Joseph Richards, Lehigh, Pa.

"The Inspection of Automobile Castings", by C. B. Wilson, Pontiac, Mich.

"Defects in Gray Iron Castings and Remedies for Them", by Herbert Ramp, Cincinnati.

"The Value of the Vibratory Test in Steel Foundry Practice", by Lloyd Uhler, Pittsburgh.

"The Particular Application of the Converter in the Manufacture of Steel Castings", by C. S. Koch, McKeesport, Pa.

"Notes on Electric Furnace Construction and Operation in the Steel Foundry", by Mr. Gray, United States Steel Corporation, New York City.

"Correct Proportions and Essentials in Checker Design for Open Hearth Furnaces", by W. A. Janssen, Bettendorf, Ia.

"Causes for Shrinkage Cracks in Steel Castings", by William Bossinger, Marion, O.

In addition to the foregoing, reports will be presented by the committees on safety and sanitation, industrial education, costs, steel foundry standards, specifications for malleable castings, specifications for gray iron castings, specifications for steel castings and specifications for foundry scrap.

Aside from the many attractions afforded by Atlantic City, the entertainment features will involve a theatre party and banquet and a committee will be in charge of plant visitation, whose members will direct the visiting delegates to the many interesting foundries in Philadelphia and vicinity. It also is probable that numerous side trips will be arranged to enable visitors to inspect the shops in which they are interested, with the least amount of inconvenience.

Headquarters for the American Foundrymen's Association will be at the Marlborough-Blenheim hotel. The meetings will be held on Young's Steel Pier, where the registration booth also will be located.

C. E. Hoyt, secretary of the Foundry & Machine Exhibition Co., Lewis Institute, Chicago, reports that the space reservation already made, foreshadows one of the largest exhibitions ever held. Young's Steel Pier is admirably adapted for show purposes and all facilities are provided for the rapid building and installation of machinery. The exhibition will be opened formally on Saturday, Sept. 25, and will close Friday, Oct. 1.

Program of Institute of Metals

ARRANGEMENTS are being completed for the annual meeting of the American Institute of Metals, which will be held in Atlantic City, Sept. 28 to Oct. 1. Headquarters have been established at the Hotel Traymore and a number of unusually important papers will be read and discussed.

Among the papers already arranged for are the following: "Albany Sand", by D. H. Newland, assistant state geologist, New York; "Experience with Brass in Civil Engineering Works", by A. D. Flinn, board of water supply, New York; "Molding Sand", by C. P. Karr, bureau of standards, Washington, D. C.; "Aluminum Die Casting Work", by Charles Pack, Doehler Die Casting Co., New York; "Cracking of Wrought Brass from Overstrain", by Dr. Burgess and Dr. Merica, bureau of standards; "Manufacture and Use of Alumino-Vanadium", by William W. Clark, Seymour Mfg. Co.; "Some Developments in Aluminum", by C. V. Powell, British Aluminum Co., Toronto, Ont.; "The Advantage of a Standard Railroad Bearing Alloy", by Russell R. Clarke, Pennsylvania Lines West; "Silicon Resistance Furnaces for Melting Brass", by Dr. Weintraub, General Electric Co., Schenectady, N. Y.; "Effect of Zinc on Copper, Tin and Lead Alloys", by G. H. Clamer, Ajax Metal Co., Philadelphia; "Copper-Aluminum Alloys", by W. M. Corse, Titanium Alloy Mfg. Co., Niagara Falls, N. Y.; "Forging Manganese Bronze", by Jesse L. Jones, Westinghouse Electric & Mfg. Co., Pittsburgh; "Amorphous State of Metals", by S. L. Hoyt, University of Minnesota, Minneapolis, Minn.; "Method of Analysis for Complex Alloys" and "Development of Acid Resistance Alloys", by S. W. Parr, University of Illinois; "Metallographical Examination of 88-10-2 Alloy", by Dr. Rawdon, bureau of standards, Washington; "Electric Furnaces for Brass Meltings", by F. A. J. FitzGerald, FitzGerald Laboratories; "Cobalt in Non-Ferrous Metals", by H. T. Kalmus, Kalmus, Comstock & Westcott, Inc.; "The Elec-

(*Continued on page* 288.)

THE FOUNDRY

A monthly journal devoted to all branches of the foundry trade

Published by

The Penton Publishing Co.

Penton Building, CLEVELAND

BRANCH OFFICES

BIRMINGHAM, ENG.	Prince's Chambers
CHICAGO	1521 Lytton Bldg.
CINCINNATI	312 Johnston Bldg.
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SUBSCRIPTION

United States and Mexico	$1.00 a year
Canada	$1.50 a year
Great Britain and other Foreign Countries	Eight Shillings
Single Copies	15 cents

Copies published three months or more previous to date of current issue, 25 cents each.

ADVERTISING

All communications relating to advertising copy, discontinuances, etc., must be received on the 10th of the month preceding date of publication.

Entered at the Post Office at Cleveland as Second Class Matter

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Trade Outlook

BETTER business conditions are noted in the foundry trade throughout the country, although certain sections are enjoying much greater activity than others. War orders continue to occupy the center of the stage, but critical observers of the trend of industrial conditions are gratified to note an increase in purely domestic activities. Railroad equipment orders are still below normal, but show such a remarkable increase over the low point reached last December that the present situation is looked upon as favorable. In addition to fair car orders from domestic railroads, including a recent inquiry for 1,500 box cars from the Chicago & North-Western, the governments of Russia and France both have entered the railway equipment market of the United States on an extensive scale. This business is having a favorable effect upon the malleable shops and other foundries catering to the railroad trade. The production of merchant pig iron during May was 535,325 tons, a gain of 24,570 tons over April, and it is believed the June figures will show a merchant furnace production of fully 575,000 tons. The total pig iron production in May was 2,250,556 tons, or 136,038 tons in excess of April, this total being the largest since March 1914. Pig iron now is being made in the United States at the rate of approximately 27,000,000 tons per year.

Prices of non-ferrous metals remain exceedingly high, although during the latter part of June spelter showed a tendency toward weakness. Spot spelter is now quoted at 18 cents, St. Louis; casting copper, 30 days, is held at 20 cents, New York. Pig iron prices have changed only slightly during the past 30 days, No. 2 foundry being quoted in the leading centers, as follows: Pittsburgh, $13.45; Cleveland and Chicago, $13; Philadelphia, $14; Buffalo, $12.50, and Birmingham, $9.50. Malleable is held at $13, Chicago; $12.50, Buffalo, and $15, Philadelphia. Lake Superior charcoal is quoted at $15.25, Chicago, and $15.75, Buffalo.

Non-Ferrous Metal Output

FIGURES recently have been issued by the United States Geological Survey, covering the production of copper, lead and zinc in the central states, consisting of Arkansas, Illinois, Kansas, Kentucky, Michigan, Missouri, Oklahoma and Wisconsin, in 1914. This great non-ferrous metal producing district last year had an output of 164,398,821 pounds of copper, as compared with 136,429,613 pounds the previous year; the production of lead aggregated 203,845 tons, an increase over the previous year with 187,701 tons, and the zinc output in 1914 was 168,032 tons against 180,169 tons in 1913. Michigan continues to be the largest copper-producing state in the central district with a total of 164,344,058 pounds, Missouri ranking second with 44,463 pounds. On the other hand, Missouri leads in both lead and zinc production with an output of the former of 192,612 tons and of the latter of 105,994 tons.

Foundry Industry Loses Leader in Accident

Thomas D. West Succumbs to Injuries Received When Struck by Automobile —Father of Literature of Foundry Practice and Pioneer in Safety Movement

THOMAS DYSON WEST, foundryman, father of the literature of foundry practice in the United States and an indefatigable worker in the cause of safety, died at Glenville hospital, Cleveland, June 18, as the result of injuries received the evening before, when struck by an automobile. Mr. West was crossing the street near his residence when he was struck, and was removed to the hospital, where the end came a few hours later. He was born Aug. 31, 1851, in Manchester, Eng. When an infant, he was brought to the United States by his parents and spent his childhood days in Portland, Me. When 12 years of age, he began working in the foundry of the Portland Locomotive Co. He served his apprenticeship in Portland and Bangor, and also worked for a time in New York City. In 1871, he went to Cleveland, and after attending school for about three months, became a molder at the Globe Iron Works. Somewhat later he became foreman of the Vulcan Iron Works Foundry, Cleveland, where he was known as "the boy foreman". For 14 months he was in charge of the foundry of William Tod & Co., Youngstown, and upon returning to Cleveland, took charge of the foundry of William Fitzsimmons & Sons. He later managed the Variety Iron Works foundry and also what was known as the "Old Cuyahoga" foundry, which was considered at the time the leading large engine and machinery construction plant of the west. The Cuyahoga works were sold to the Cleveland Ship Building Co., Jan. 1, 1887.

A few months later, Mr. West organized the Thos. D. West Foundry Co., with Samuel Lansdowne and Charles Neracher as associates. About a year and a half later, George H. Boyd invested money in the company, enabling it to make additions to its plant. Mr. Boyd became president and treasurer. In 1890, Mr. West went to the Alice furnace at Sharpsville, Pa., to test the practicability of making ingot molds by direct metal. This experiment, undertaken for the first time in this country by him, was successful and was soon generally adopted by leading companies. While Mr. West was in Sharpsville, the Cleveland plant was burned, and in 1891, the business was moved to Sharpsville, where the making of ingot mold castings by the use of direct metal was continued. In 1909, the company was taken over by the Valley Mold & Iron Co. In 1906, Mr. West organized the West Steel Casting Co., at Cleveland, which made its first castings the following year. Mr. West's son, Ralph H., has been president of this company since its organization, while the father has served as chairman of the board of directors and managing director. This company has been very successful and is now making a large addition to its plant.

THOMAS DYSON WEST

From the time he entered the foundry as a boy, Mr. West was a close student of its operations and the issue of the *American Machinist* of Jan. 1, 1881, contained the first article which he wrote for publication. He early became a regular contributor to *The Foundry* and his many articles in this paper have attracted much attention. In 1882, his first book, entitled "American Foundry Practice", was published by John Wiley & Sons. This book is now in its twelfth edition. In 1884, Mr. West completed his second work, "Moulder's Text Book" now in its tenth edition. Upon his removal to Sharpsville, Mr. West took up the study of the metallurgy of cast iron. At that time, founders the world over were buying, mixing and testing iron by antiquated methods and Mr. West was one of the pioneers who advocated progressive methods. An important work was the creation and establishment of standardized drillings, which was taken over by the government in 1905. In 1897, Mr. West published his third book, "Metallurgy of Cast Iron", which has had a very large sale and is now in its fourteenth edition. His latest book, "The Efficient Man", was published in 1914. He was also the author of six instruction booklets, which he wrote for the International Correspondence School of Scranton, Pa. Mr. West was a member of the American Society of Mechanical Engineers, American Society for Testing Materials, American Association for the Advancement of Science, Civil Engineers' Club of Cleveland, and an honory member of the Philadelphia Foundrymen's Association and also of the Pittsburgh Foundrymen's Association. He was president of the American Foundrymen's Association during 1905-1906, and for many years was one of its most active supporters.

During his later years, Mr. West had devoted a large part of his time and energy to the prevention of accidents. In 1908, he organized the American Anti-Accident Association and later wrote numerous articles and pamphlets to promote the safety movement. His latest work along this line was as chairman of the committee of Ohio foundrymen, which has been working on the framing of rules and regulations for the promotion of safety and sanitation in the foundries of that state. A few days before his death, Mr. West com-

pleted this work and was ready to present it for approval to the Ohio industrial commission. Owing largely to his efforts, the Ohio legislature recently made an appropriation to further safety work in Ohio. The industrial commission will receive $5,000 and an additional $5,000 will be available if the manufacturers of the state contribute a like amount. One of Mr. West's important contributions on the safety problem appears on page 267 of this issue.

Mr. West is survived by his widow and by three children, Dr. Thomas J. West, of Honolulu; Ralph H. West and Mrs. William E. Ward, of Cleveland.

Annual Meeting of British Foundrymen

The British Foundrymen's Association, like many other technical and scientific societies, has been greatly affected by the war, and its annual meeting held in London on Saturday, June 5, was shorn of a great deal of its interest, owing to the necessity for curtailing the program. No papers were read, and to a large extent the meeting was of a purely formal character. The total membership is 1,047, compared with 974 at the time of the 1914 annual meeting.

The following officers were elected for the ensuing year: W. Mayer, president; J. Ellis, senior vice president; T. H. Firth, junior vice president; F. W. Finch, treasurer, and E. A. Pilkington, secretary. J. E. Allbut, H. Pemberton, T. Swinden, W. F. Bagnall, J. G. Robinson and C. Hoggie were elected members of the council. The president promised to bring before the council the suggestion that there should be a stronger representation of patternmakers on the board.

Institute of Metals

(*Continued from page* 285.)

tric Furnace for Sherardizing", by Dr. S. Trood, U. S. Sherardizing Co.; "The Effect of the Present European War on the Metal Industries", by Thomas F. Wettstein, United Lead Co.: "Stellite", by Elwood Haynes, Haynes Stellite Works, Kokomo, Ind., and "Analysis of Babbitt Metals", by Prof. D. J. Demarest, Ohio State University, Columbus, O.

The secretary of the American Institute of Metals announces that the proposed changes in the constitution have been adopted. As a result the annual dues will be increased from $5 to $10 per year. Also, a new form of membership, known as corporation membership, has been established for the benefit of concerns that wish to lend their financial support to the Institute, giving their various representatives a little lower rate per capita, when the number is three or more, than would be available by taking out straight individual memberships. The arrangement also will enable foremen and other members who do not wish to secure the bound volume of the *Transactions* to obtain all the privileges of the meetings and to receive advance copies of the papers at the same rate as at the present time.

The secretary also has announced that the *Transactions* are becoming so large and comprehensive that it was deemed advisable to secure the services of an expert editor. Charles Vickers, Titanium Alloy Mfg. Co., Niagara Falls, N. Y., formerly associate editor of *The Foundry*, has been retained for this purpose and will edit volume VIII.

An Appreciation of Thos. D. West

By Dr. Richard Moldenke

Mr. West was called from his activities, much too soon for the good of the foundry industry, but not too late to have experienced within his lifetime the rare satisfaction of achieving success, and seeing his work for foundry betterment accepted as authoritative the world over. He was recognized as a foremost authority on practical foundry operation. He was a genial, optimistic, whole-hearted man, full of sympathy toward his fellows, but none the less ready to apply the surgeon's knife to the roots of inefficiency, self-indulgence, incapacity and carelessness he saw springing up to engulf mankind. The modern movements for safety and efficiency owe much of their early progress to him—to his facile pen and constant and unremitting effort. To record all of his services to the foundry world would fill many pages. Old and young foundrymen the world over will mourn his loss. His amiable qualities will live long in their memories, and his constant striving after the truth will help to spur on others to do likewise. Truly of him it can be said that "his works live after him."

Personal

L. S. Jones has been appointed sales manager of the Lumen Bearing Co., Buffalo.

J. J. Trefz has been elected manager of the Southern Foundry Co., Owensboro, Ky.

Charles U. Geesey has been appointed chief chemist of the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich. Mr. Geesey formerly was employed as chief chemist of the Gary, Ind., plant of the United States Steel Corporation.

George C. Wilson, affiliated with the main office of the Independent Pneumatic Tool Co., Chicago, has been appointed manager of that company's branch at Atlanta, Ga., succeeding F. H. Charbono, who has been transferred to Boston.

E. W. Swartwout, formerly affiliated with the Chicago office of the Nordberg Mfg. Co., Milwaukee, now is associated with the New York office of this company, located in the Equitable building. The Chicago office of the Nordberg company will be in charge of John E. Lord.

James F. Webb has resigned as foreman of the foundry operated by the Davenport Locomotive Works, Davenport, Ia., and will devote his entire attention to the affairs of the J. F. Webb Mfg. & Supply Co., Davenport, manufacturer of molding machines.

Joseph Battles has been appointed district sales manager of the Terry Steam Turbine Co., Hartford, Conn., for the states of New Mexico, Colorado, Wyoming and the western section of Nebraska. Mr. Battles' headquarters are in the First National Bank building, Denver.

John C. Haswell, Marion, Ind., has been elected president of the Dayton Malleable Iron Co., Dayton, O., succeeding Pierce Schenck, who has resigned to enter business for himself. Mr. Haswell also is vice president of the Marion Malleable Iron Works, vice president of the Marion Gray Iron Foundry Co., secretary and treasurer of the Atlas Foundry Co., all of Marion, Ind., and secretary and treasurer of the Gartland Foundry Co., Terre Haute, Ind.

Merton A. Pocock has been appointed district sales manager of Minnesota, North Dakota and South Dakota of the Terry Steam Turbine Co., Hartford, Conn. Mr. Pocock's office is in the Endicott building, St. Paul, and this arrangement supersedes the Terry company's previous selling agreement with the Robinson, Cary & Sands Co., of St. Paul. The Hawkins-Hamilton Co., Peoples National Bank building, Lynchburg, Va., has been appointed the representive of the Terry Steam Turbine Co. for the state of Virginia.

The Brennan Steel Castings Co., 2284 Scranton road, Cleveland, has made important improvements to its plant, including the erection of a 50 x 150-foot building. New equipment also will be purchased, including sprue cutting machinery and jar-ramming molding machines.

The Georgetown Foundry & Machinery Co., Ltd., Georgetown, Ont., Can., recently incorporated with $40,000 capital stock by John A. Willoughby and others, will build a plant for the manufacture of knitting machines and foundry products.

Improved Chipping Hammers and Foundry Rammers

The Keller Pneumatic Tool Co., Fond du Lac, Wis., recently has made important changes in the construction of its line of pneumatic chipping hammers and foundry rammers. All parts exposed to wear, including the cylinders which ordinarily are soft, are hardened and ground. The wear usually occasioned by the piston striking the chisel and making necessary periodical re-reaming of the cylinder and the installation of larger pistons has been eliminated by the use of hardened cylinders. Differential piston construction is employed in the chipping hammers. The air that returns the piston is not exhausted and therefore no live air is blown from the front of the tool. This effects considerable economy in air consumption. These hammers are arranged for the use of 7/8-inch octagonal shanks, which eliminates the forging, turning or milling of shanks when special hexagonal, round or differential shanks are specified for use. This tool is well adapted for steel foundry work.

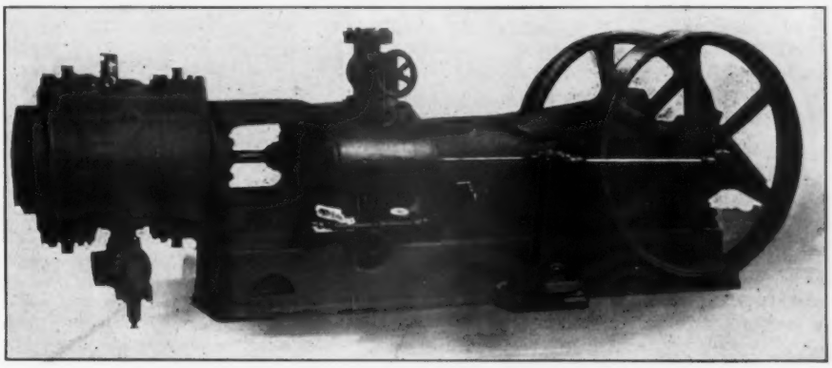
The sand rammer manufactured by the Keller company also has been improved, the cylinder being of one-piece construction and also is hardened.

Nitre Cake for Pickling

As a base for a pickling solution for cleaning castings and other forms of metal of scale, oxides and other foreign substances, the E. I. duPont de Nemours Powder Co., Wilmington, Del., has introduced a by-product which is called nitre cake. This substance, which is the principal by-product of nitric acid manufacture, contains approximately 32 per cent available sulphuric acid and is technically known as acid sodium- sulphate. It is a fused salt, usually supplied in large lumps, varying in color from white to a light yellow. It is readily soluble in water and gives a decided acid reaction. The solution is said to be fully as efficient as weak sulphuric acid, and in many cases more desirable than liquid sulphuric acid, being less dangerous to handle. It is claimed the solution of nitre cake will not pit the surface of metal from which the scale or oxide is being removed. The mild action of this solution also makes it valuable in preparing surfaces for annealing, tempering, welding and for brazing operations. Nitre cake also is used extensively as a base for cleansing compounds and polishes, while in the metallurgical industry it has been found valuable as a flux, for flotation work and for leaching ores. United States patents cover the use of nitre cake as a pickling agent under which the E. I. duPont de Nemours Powder Co. grant licenses to customers who wish to use the material as a pickling agent.

Small Steam-Driven Air Compressors

The constant demand for higher efficiency and greater economy and the increasing tendency toward the use of higher steam pressure have lead to the development, by the Ingersoll-Rand Co., New York City, of the small steam-driven high-speed air compressor shown in the accompanying illustration. This machine is designed along the same lines as the company's former small steam-driven type, but it embodies many improvements which give it a higher efficiency in the air end and insure a considerably lower steam consumption. The compressor is equipped with Ingersoll-Rogler air valves which allow of high speeds, give high compression efficiency and are almost silent in operation. The compressor also is equipped with balanced piston steam valves which permit of higher speeds, high steam pressures and the use of superheated steam.



INGERSOLL-RAND SMALL STEAM-DRIVEN AIR COMPRESSOR

The automatic cut-off control gives the high steam economy under conditions of varying load or varying steam pressures. This control is regulated by a centrifugal flywheel governor which acts to shorten or lengthen the stroke of the piston valve, thus changing the cut-off.

The lubrication is of the automatic splash type and the enclosed construction and removable covers insure cleanliness and accessibility.

WHAT THE FOUNDRIES ARE DOING

Activities of the Iron, Steel and Brass Shops

The foundry of the Anderson Scale & Paint Co., Hamilton, O., has been purchased by the Lavelle Foundry Co., Anderson, Ind.

Preston & Wade, Canton, Ill., founders and machinists, will install foundry equipment for the manufacture of brass castings.

The Star Foundry Co., Troy, O., has been incorporated with $10,000 capital stock by W. P. Anglemyer, Arthur Lockwood, Jacob Lust, J. M. Berman and J. C. Fullerton Jr.

The South Bend Brass Foundry & Machine Co., South Bend, Ind., has been incorporated with a capital stock of $15,000 by George H. Thayer Jr., F. N. Troupe and P. M. Thayer.

The Cast Steel Locomotive Ashpan Co., St. Louis, Mo., has been incorporated with $40,000 capital stock by H. M. Pflager, Arthur T. Morey and Fred W. Dieckmann.

Pierce D. Schenck, formerly president of the Dayton Malleable Iron Co., Dayton, O., has purchased and will operate the plant of the Dayton Foundry Co.

The Tulsa Stove & Foundry Co., Tulsa, Okla., has been incorporated with $60,000 capital stock by C. C. Spitznagle, H. E. Bartlett, W. E. Rhode and George Kennedy.

The Cleveland Modern Foundry Co., Cleveland, O., has been incorporated with $5,000 capital stock by F. W. Zimmerman, M. J. McCarthy, H. E. McCormick and others.

The Detroit Bronze Castings Co., Detroit, has been incorporated with a capital stock of $2,000 by Albert F. Mochrie, Kenneth K. and Millie Hall.

The Cedar Rapids Foundry & Machine Co., Cedar Rapids, Ia., has increased its capital

stock from $25,000 to $50,000 for the purpose of extending its business.

The Merrimac Foundry & Machine Co., Lawrence, Mass., contemplates moving to a new location, where it will have the benefit of a side track and more land.

The foundry of the East River Iron & Brass Works, Green Bay, Wis., has been leased by Theodore and A. Helgerson and will be operated under the name of the Helgerson Brothers Iron Works.

The 148 x 278-foot plant of the Eureka Foundry Co., at Richmond and Court streets, Cincinnati, has been purchased by the Bickett Machine Co. and will be remodeled and occupied at once.

The Mohn Foundry, Reading, Pa., formerly conducted by the late William H. Mohn, has been sold to Edwin A. Moore, of the firm of Elmore E. Moore & Brother, coal dealers, Philadelphia.

The Jackson Iron & Bronze Works, Jackson, Tenn., contemplates establishing a foundry in connection with its ornamental iron plant and will increase its capital stock to $50,000.

The Keystone Brass Mfg. Co., Detroit, has been incorporated with a capital stock of $20,000 to engage in the manufacture of brass articles and operate a brass foundry. Michael H. Green, George C. Leonard and Clifton P. Weil are the incorporators.

The Wray Fresh Water Supply Co., Kewanee, Ill., has taken over the machine shop equipment, etc., of Hedburg Brothers and the Kewanee Brass Foundry Co. has bought their foundry. A new brass furnace will be installed.

The property of the Catasauqua Casting Co., Catasauqua, Pa., will be sold at sheriff's sale shortly. The company manufactured all kinds of heavy castings, including clutches and gears for large machinery until several years ago, when the plant was closed.

New Construction

August Gottschlich, Oskaloosa, Ia., will erect an addition to his foundry.

The D. J. Barber Foundry Co., Brighton, Ont., Can., will build an addition to its plant.

The Weir Stove Co., Taunton, Mass., has awarded the contract for its proposed 1-story, 65 x 160-foot foundry.

The American Malleable Co., Owosso, Mich., has let the contract for the erection of a 1-story, 36 x 75-foot addition to its plant.

The American Foundry & Machine Co., Hamilton, O., will build a 1-story, 90 x 100-foot brick addition to its plant.

The St. Clair Foundry Co., Toronto, Ont., Can., will build an addition to its plant at a cost of $2,000.

The Reading Steel Casting Co., Reading, Pa., will build a 1-story, 40 x 62-foot foundry at a cost of approximately $4,000.

The Consolidated Wagon & Machine Co., Twin Cities, Ida., is having plans prepared for a foundry.

The Kilby Locomotive & Machine Works, Anniston, Ala., will erect a malleable foundry and is in the market for equipment.

The plant of the Iron City Stove & Foundry Co., Bristol, Va., recently purchased by J. Gutman, will be enlarged and improved.

Work has been started on the foundry of the Wilmington Castings Co., Wilmington, O., recently incorporated with $30,000 capital stock. Equipment will be installed shortly.

Work has been started on the 1-story, 40 x 70-foot addition to the plant of the Miami Brass Foundry Co., Dayton, O. Some foundry equipment will be purchased.

The North End Foundry Co., West Allis, Wis., is erecting a 1-story, 60 x 80-foot addition to its new plant built about 18 months ago.

Contract has been awarded for the erection of a 1-story foundry and coal storage building, 222 x 234 feet, of steel and brick construction, for the American Radiator Co., Buffalo.

The Ansonia Brass & Copper Co. branch of the American Brass Co., Ansonia, Conn., will erect a brick and steel casting shop, 130 x 300 feet.

Smith, Hynchman & Grylls, 710 Washington arcade, Detroit, are preparing plans for a brass foundry, five stories, 90 x 133 feet, for John B. Corliss, 34 Canfield avenue, West Detroit.

The Detroit Valve & Fittings Co., Wyandotte, Mich., is building an addition to its plant which will increase its capacity 50 per cent.

Plans have been made for an addition to the plant of the Dayton Malleable Iron Co., Dayton, O. Some new equipment will be purchased.

The Snead & Co. Iron Works, Inc., Jersey City, N. J., manufacturer of architectural and ornamental iron, etc., is erecting a 2-story reinforced concrete pattern shop.

The J. S. Williams Foundry Co., Buffalo, N. Y., has awarded the contract for a 1-story, 33 x 136-foot and 82 x 142-foot pickling and storage building.

Plans have been completed for a 3-story, 50 x 159-foot addition to the plant of the Waterbury Farrell Foundry & Machine Co., Waterbury, Conn.

The Allis-Chalmers Mfg. Co., West Allis, Wis., is erecting a foundry, one and two stories, 85 x 112 feet, and a factory building, 5 stories, 165 x 196 feet.

The Duncan Foundry & Machine Works, Alton, Ill., is erecting a new plant which will have twice the capacity of the former plant.

Contract has been awarded for the erection of a brick building, 100 x 100 feet, for the Special Machinery & Foundry Co., Martinsville, Ind.

The Union Mfg. Co., New Britain, Conn., manufacturer of chucks and castings, has let the contract for a 5-story, 47 x 160-foot brick building.

Samuel L. Moore & Sons, Elizabeth, N. J., will construct a ship yard at a cost of approximately $1,000,000. The old ship yard will be thoroughly renovated and a new foundry and new piers will be erected.

The Jordan L. Mott Co., Trenton, N. J., is adding 19 new furnaces to its foundry and building a 500-foot railroad spur to reach the proposed new building where war munitions will be made.

Architects Mellor & Meigs, 205 South Juniper street, Philadelphia, are taking bids on a 2-story, 40 x 100-foot ornamental iron foundry to be erected at Arch and Allison streets for Samuel Yellin, 217 Jefferson street.

The city of Chicago is erecting a foundry, 21 x 141 feet, a blacksmith shop, 40 x 90 feet and a 2-story machine shop, 50 x 306 feet, at 3100 South Sacramento avenue. The cost will approximate $230,000. C. W. Kallel is the architect.

Plans have been prepared for a new plant, including machine shop, forge shop, casting storage house, erecting and testing shop, boiler shop, tin shop, foundry and pattern storage house, to be erected for the Port Huron Engine & Thresher Co., Port Huron, Mich.

NEW TRADE PUBLICATIONS

OIL-DRIVEN COMPRESSORS. — Instructions for installing and operating the fuel oil-driven compressors built by the Chicago Pneumatic Tool Co. are contained in a 24-page bulletin. All users of this equipment will find this bulletin of great value, as the instructions for installation and operation are unusually complete.

AIR COMPRESSORS. — Two catalogs recently issued by the Ingersoll-Rand Co., New York City, are devoted respectively to steam-driven, single stage, straight line air compressors and the Leyner-Ingersoll water drill. The air compressor catalog is well illustrated and shows the details of the machine in section. Among the principal features of construction are the air valves in the air cylinder and the balanced piston steam valve with automatic cut-off control in the steam cylinder.

CIRCULAR STORAGE SYSTEM.—A four-page bulletin issued by the Link-Belt Co., Chicago, illustrates and describes its circular system for storing coal and similar materials with long radius locomotive cranes. One circular storage crane shown is steam-operated, runs on 20-foot gage tracks, is equipped with a 3½-ton bucket and has a radius of 110 feet. The advantages of this system also are pointed out and numerous illustrations are included of various storage systems installed.

GASOLINE ENGINES.—In the catalog recently issued by the Chicago Pneumatic Tool Co., Chicago, gas and gasoline engines built, in six sizes and ranging in horsepower from 16 to 130, are illustrated and described. These are similar in general design to the fuel oil-driven engines built by this company with the exception that they are intended for operation with artificial or natural gas.

DIRECT CURRENT COMMUTATING POLE MOTORS.—In a 16-page bulletin, issued by the General Electric Co., Schenectady, N. Y., its direct current commutating pole motors are illustrated and described. The frame of these machines is cast steel, of medium weight, with symmetrical section. The motors can be used with a sliding base which maintains a correct driving alignment and this, with the adjustable shields, permits the installation of the motor on either the floor, wall or ceiling. The motors also may be equipped with covers, rendering them semi-enclosed, totally enclosed or self-ventilated. They are wound for 115, 230 and 550 volts direct current circuits with a permissable voltage range from 110 to 125, 220 to 250 and 500 to 600 volts.

MONEL METAL.—The International Nickel Co., New York City in a 16-page booklet recently issued, briefly discusses the properties of Monel metal which is a natural alloy consisting approximately of 67 per cent nickel, 28 per cent copper and 5 per cent other metals. The mines from which the ore is obtained are located in the Province of Ontario, Canada, and are operated by the Canadian Copper Co., a subsidiary of the International Nickel Co. The refined metal can be manufactured in the form of rods, castings, forgings, tubes, wire, strip stock, sheets, etc. In color, this metal closely resembles nickel, while its tensile properties are similar to that of steel. This metal is also highly resistant to corrosion and to the eroding and cutting action of superheated steam.